UNITED STATES NAVAL INSTITUTE PROCEEDINGS

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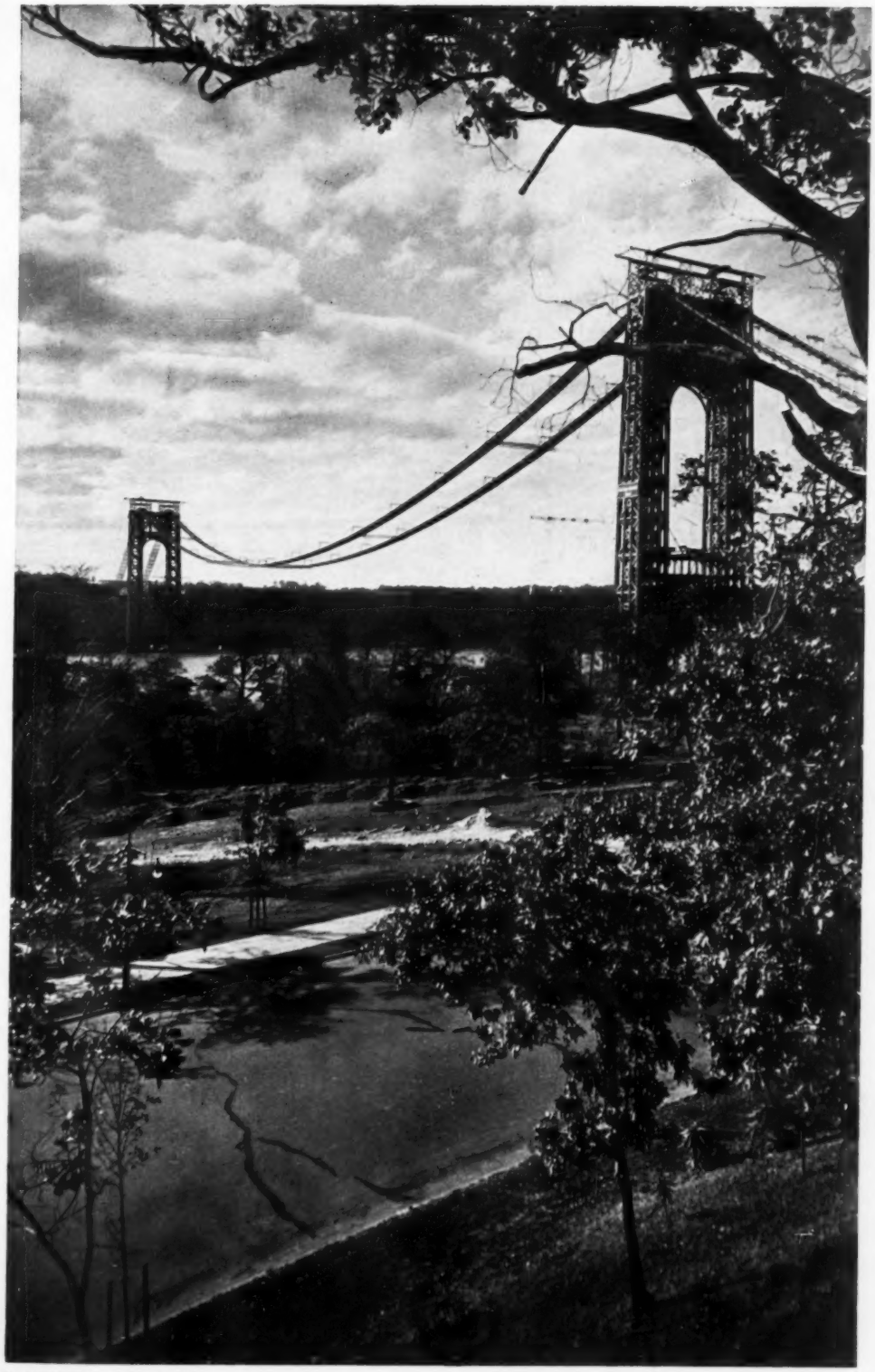

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NEW HUDSON RIVER BRIDGE AT NEW YORK
A view of the towers and cables of 3,500-foot span.

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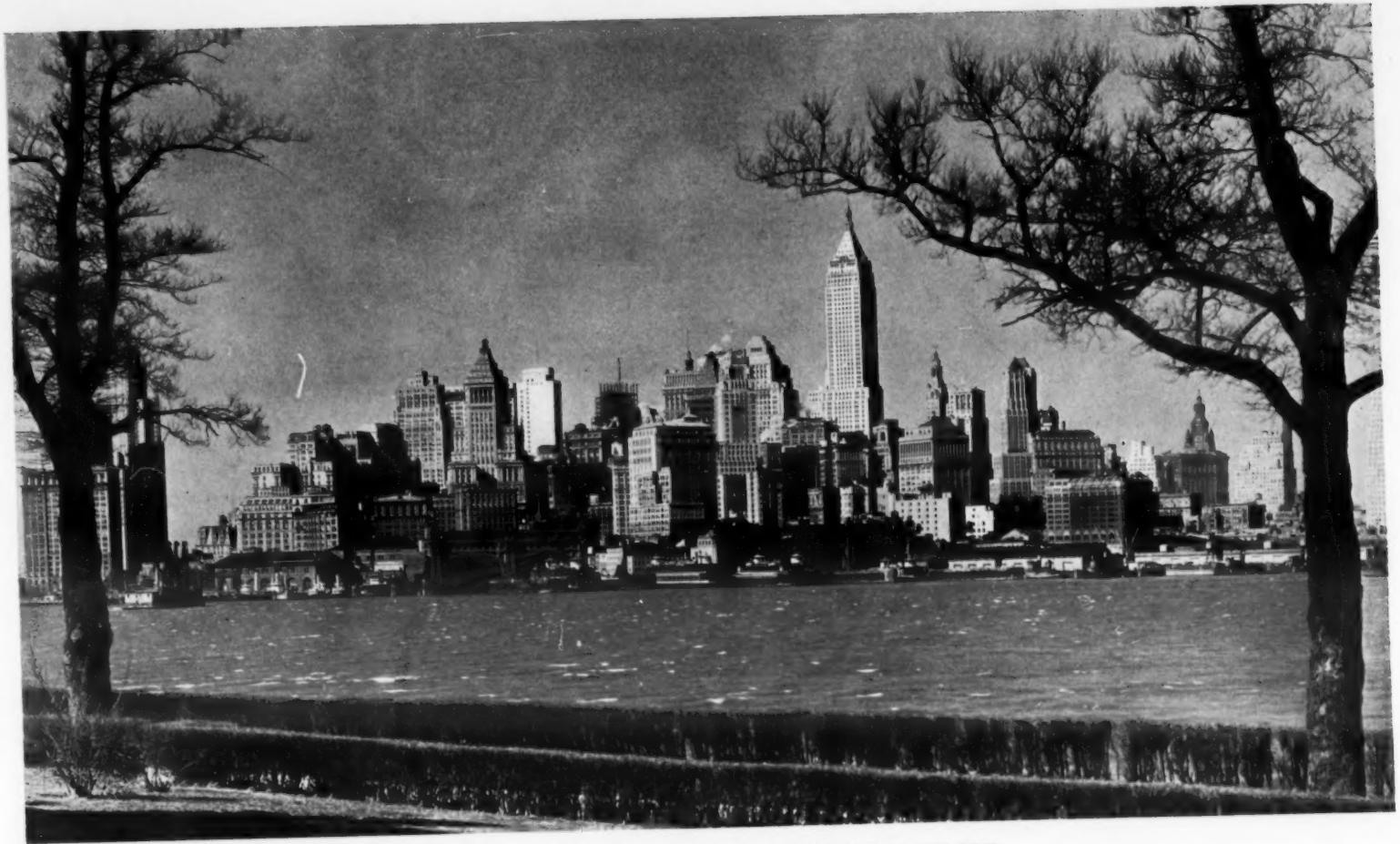

By Ewing Galloway, N.Y.

A NEW VIEW OF THE FAMOUS LOWER MANHATTAN SKY LINE

This view was taken from Governors Island with the new seventy-one story Bank of Manhattan building dominating the scene.

This view was taken from Governors Island with the new seventy-one story Bank of Manhattan Building dominating the scene.

By Ewing Galloway, N.Y.

SOLDIERS AND SAILORS MONUMENT, RIVERSIDE DRIVE, NEW YORK CITY

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By Ewing Galloway, N.Y. RIVERSIDE DRIVE, NEW YORK, WITH THE PALISADES ON THE NEW JERSEY SIDE IN THE DISTANCE

By Ewing Galloway, N.Y.

RIVERSIDE DRIVE, NEW YORK, WITH THE PALISADES ON THE NEW JERSEY SIDE IN THE

By Ewing Galloway, N.Y.

AIR VIEW OF MANHATTAN

This is lower Manhattan from over the Hudson River, looking toward Brooklyn. The view shows practically all of the financial district, East River, Brooklyn Bridge (right), Manhattan Bridge, and a considerable portion of Brooklyn in the background.

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ELMS ON RIVERSIDE DRIVE, NEW YORK

By Ewing Galloway, N.Y.

MANHATTAN FROM A HEIGHT OF 3,500 FEET

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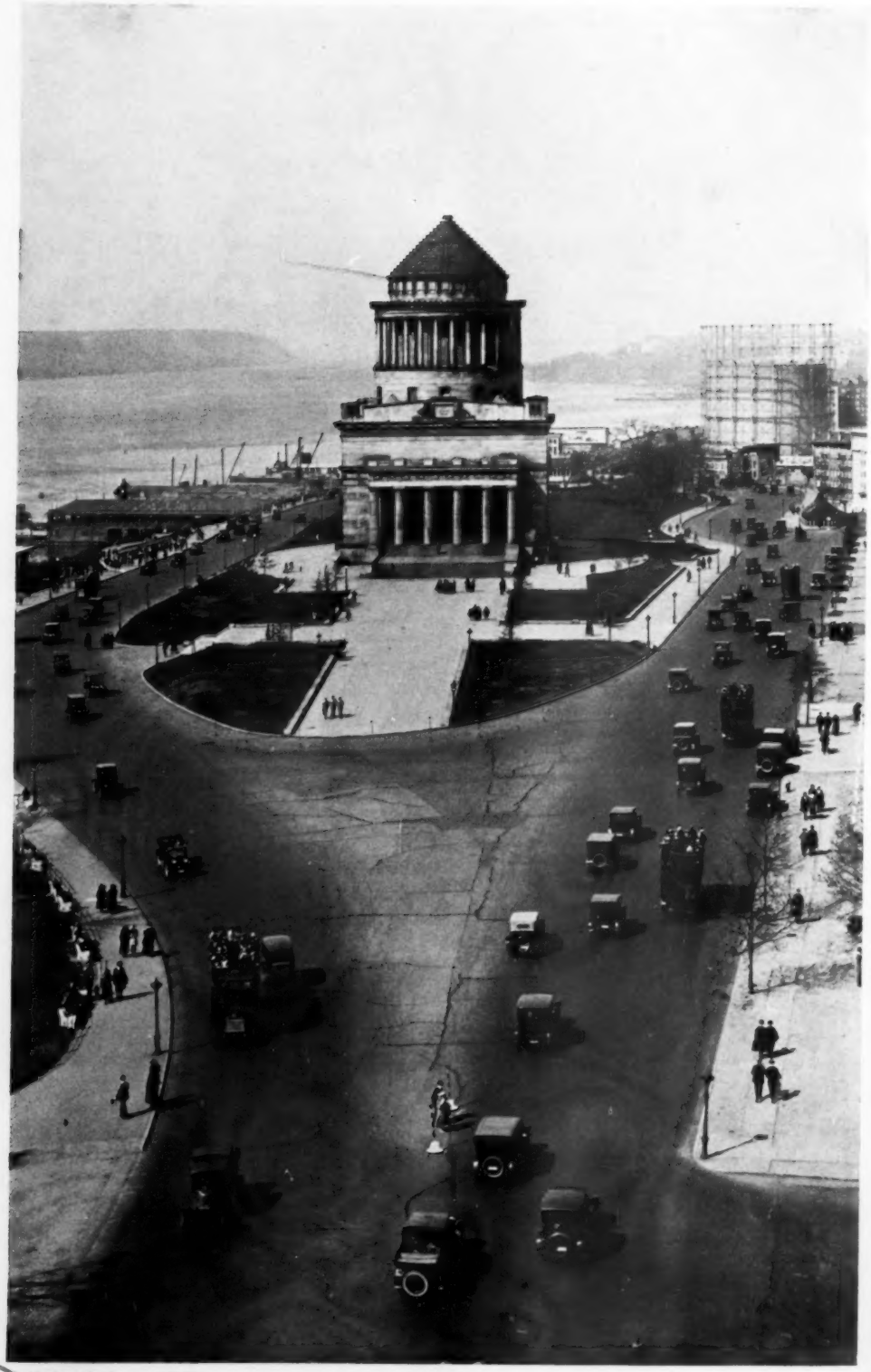

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GRANT'S TOMB AND RIVERSIDE DRIVE, NEW YORK

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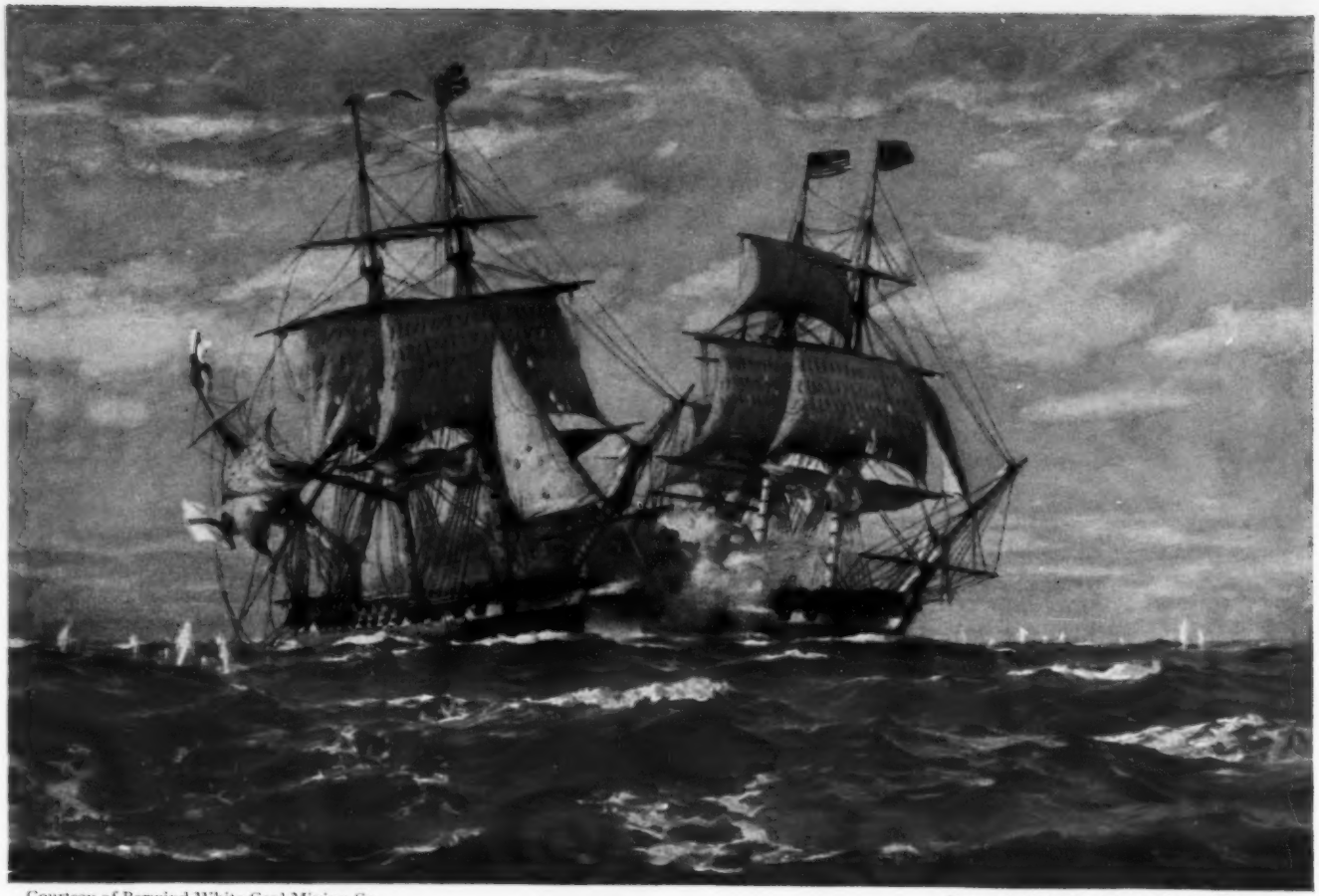

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CONSTITUTION AND GUERRIERE

The first frigate action of the war of 1812 would not have taken place when it did, on August 19, 1812, had not Captain Hull, of the *Constitution*, put to sea from Boston on the 2nd of August fearing that the timid policy of the Navy Department might detain him in port. A few days after his departure, orders arrived at Boston for him to "remain in port until further orders;" and "had the *Constitution* been captured on this cruise," remarked Rear-Admiral Bell, "Hull would have been hanged or shot for sailing without orders."

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The Supervisor *of* New York Harbor

By CAPTAIN WALTER S. ANDERSON, *U. S. Navy*

OF THE various details to which a United States naval officer may be assigned, several are unique. One of these is supervisor of New York Harbor. This office is unique in several particulars. It is no wonder that but few people understand what its functions are. The title is so comprehensive that one might imagine its powers to be considerably more extensive than they actually are. Let it be said at once that the supervisor has nothing to do with catching rum-runners, nothing to do with assigning anchorages, and nothing to do with customs or quarantine. And yet the supervisor's office has a function that is of real importance, more than justifying the $180,000 a year that it costs the U. S. government to maintain it and the service which it directs.

That New York has a great harbor, forming the busiest port in the world, can hardly be unknown to the public. But the various activities required to maintain that large and important harbor are not so well known. Perhaps it may not be without interest to tell of the particular phase of that work with which the supervisor of the harbor concerns himself.

In 1888 a federal law was passed, entitled, "An Act to prevent obstructive and injurious deposits within the harbor and adjacent waters of New York City, by dumping and otherwise, and to punish and prevent such offenses." By this law, no dredged, excavated, or other refuse material, including also sludge and acid, can be moved or deposited in New York Harbor or its adjacent and tributary waters, except under permit issued by the supervisor of the harbor. This law provides various penalties, ranging from fines of $250 up to ten times that amount, together with imprisonment of from one month to a year in addition. It further provides that punitive damages of five dollars a cubic yard may also be assessed for dredged material illegally deposited. This federal law was so worded as to make everyone liable, including shore and marine contractors, owners, officers and crews of ships, towboats, and scows that might be involved in any way in an improper dumping transaction. There were various additional provisions of the law, as amended and added to in 1894, in 1908, and in 1909.

The law provides that its provisions shall be enforced by a line officer of the Navy, to be designated by the President of the United States as supervisor of New York Harbor, who, under the Secretary of War, is to have direct charge of the patrol boats and other means to detect and bring to punishment offenders against the provisions of the act. For the convenience of the Secretary of War, it was decided that he would exercise his control of the supervisor through the chief of engineers of the Army, who therefore is now the immediate superior of the supervisor. This is a very natural and convenient arrangement, in

view of the fact that the chief of engineers and his Army engineers carry out the provisions of the various river and harbor acts for the maintenance and improvement of the navigable waters of the United States. The work of the supervisor and of the Army district engineers of the New York and New Jersey districts touch and even overlap not infrequently.

All these offices are situated in the Army Building, at 39 Whitehall Street, not far from South Ferry, New York City. Considerable assistance is rendered the supervisor by the district engineers and their staffs, who superintend, and are therefore familar with, all dredging and filling work which affects the harbor. Also the engineers in charge of the very considerable floating plant of the first district engineer are of assistance to the supervisor in the maintenance of his floating plant.

The organization of the supervisor's office is a peculiarly compact one, with the necessary authority right in the hands of a single individual, the supervisor. In addition to being adminstrative head of the office in its enforcement duties, the supervisor is also his own disbursing officer. He pays all the bills of his office, including the salaries of its personnel, some seventy persons. The office force consists of six people. The field force includes the rest of the personnel. There are five patrol vessels of the tug type, each about one hundred and ten feet long, each with a crew of about ten, including master, mate, two engineers, cook, firemen, and deck hands. There is also one launch, manned by one inspector. The field force includes two inspectors who cover the harbor water front.

The personnel under the supervisor's orders is entirely civilian. The office force, inspectors, masters, mates, and engineers, are all classified civil service employees. Masters and mates have also authority as inspectors. Other personnel on the boats, that is, cooks, deck hands, and firemen, are unclassified civil service employees, and can quit or be "hired and fired" without formality. Any other arrangement would be an impracticable one.

Of the patrol boats, two are constantly on duty night and day. Another one patrols the harbor by day. This vessel is fitted for the accommodation of the supervisor, who of course inspects the harbor in person from time to time. As the limits of the supervisor's authority include not only New York Harbor, but also Long Island Sound, and their tributary and adjacent waters, including, of course, Newark Bay and its tributaries, and also the Hudson River to the limits of tidal waters, it will be appreciated that the supervisor requires a vessel on which he could if necessary be accommodated for several days. Therefore the patrol boat *Vigilant* is appropriately fitted and equipped for his use.

Of the five tug-type patrol boats, one is new, having just been completed. It was built especially for this duty to replace an old boat which has now been sold. Another boat is to be replaced as soon as a second new boat can be got under construction and completed. Then there should not be any necessity for a new boat for several years.

Problems of operation of the floating plant under the supervisor's office are the same in miniature as those with which all officers of the Navy are familiar. There must be supplies, fuel, repairs, and overhauls. Where feasible, advantage is taken of naval supplies and fuel. However, it is a special problem, and must be handled as such. For example, it would be uneconomical to dock these tugs in the large dry docks of the navy yard. The commissary supplies must be furnished frequently and in small quantities. In general good tugboat practice must be followed if the government's interests are to be conserved, and private contractors are made use of as necessary.

Since the organization of the supervisor's office in 1889, it has supervised the disposition of more than seven hundred and fifty million cubic yards of dredged, excavated, and other refuse material. This is more than twice the total amount of material both the French and the Americans excavated in building the Panama Canal and its terminal harbors. It can be appreciated how soon its unsupervised disposition would result in actually blocking the harbor and channels, and destroy the water-borne commerce so vital to the economic life not only of New York City, but of the entire United States. The supervisor finds welcome assistance in the recommendations of the Army engineers. Necessarily the coöperation must be close, and it is.

The principal authorized dumping grounds are fixed at sea a certain number

of miles to the southeastward of Scotland Lightship. These are as established by the supervisor. Mud must be taken out three miles; cellar dirt, four miles; rock, six miles. Dumping cannot take place in less than a certain specified minumum depth of water. Garbage is required to be taken twenty miles beyond Scotland Lightship in summer, and somewhat less in winter.

There are various other minor authorized dumping grounds in other locations, as off Eaton's Neck in Long Island Sound. The dumping of rock is even permitted in Hell Gate Channel, in the deeper holes, with a view to improving its difficult currents.

Cellar dirt is a term applying to the débris that results from the demolition of a building. The old Waldorf Astoria Hotel is being demolished right now—as well as numerous other buildings—and is being deposited at sea off Scotland Lightship under the prosaic name of cellar dirt. Thus "Peacock Alley" is humbled, and we are reminded that "paths of glory lead but to the grave."

Garbage is a sore subject. The War Department has for a good many years, directly and by the supervisor, urged New York City to provide other disposition of its garbage and refuse than by dumping it at sea. When it is understood that Greater New York produces daily about forty-five hundred tons of garbage and rubbish combined, the magnitude of the problem is perceived. At present some 60 per cent of that is disposed of other than by dumping at sea. The city is also busy with the construction of incinerators to take care of the rest. Official statement has been made to the supervisor that this desirable situation would be reached by the end of 1930.

Experience in the past indicates that these sanguine estimates are not to be taken too literally, however. The residents of any particular locality in which an incinerator is about to be built do not welcome it with open arms, and the city is not infrequently delayed by injunctions and other obstructive tactics. It is to be hoped that the new Sanitary Commission just established for Greater New York will be able to push along the work and finally solve the problem, and thus eliminate dumping garbage at sea. In the meantime, the state of New Jersey, by an action against the city of New York, is trying to encourage it in that direction.

The question naturally suggests itself, what effect has all this sea dumping upon the depths of the water. Needless to say, that point has not been overlooked, and from time to time soundings have been taken, and dumping grounds shifted when it appeared necessary. It is surprising how little effect a great deal of dumping has had upon the depths of dumping grounds in the open sea.

Old tugboat men tell many stories of the things that happened in the days before the establishment of the office of supervisor of the harbor. Dumping took place pretty much wherever the towboat men felt like tooting the whistle to tell the scowman to let go. Naturally they did not take any longer trips than they had to. As a result the harbor was in danger of being shoaled and ruined. It seems hard to believe, but it is a matter of record that dumping actually occurred in the channels themselves, requiring great expense for dredging to remove this material so wantonly deposited.

With the advent of the thin-hulled speed boat of the hydroplane type, attention has been concentrated upon the danger to navigation that even comparatively small pieces of wood floating in the water can be. Thin-hulled boats are easily stove in and swamped. And floating wood has always been a menace to propellers, taking a considerable and wasteful toll from the shipping interests. In the last six months even one of the patrol boats of the supervisor's office has suffered a broken propeller. That meant time lost in dock off duty and an expense of four hundred dollars. The supervisor's office endeavors to prevent the deposit of such wood in the harbor waters, and rounds up a good many offenders. The district engineer keeps two boats on the job picking up such floating wood in New York Harbor. It is surprising how much they pick up each day, and how large some pieces are. At that, New York Harbor's condition as to cleanliness compares favorably with that of the great harbors of the world.

The Army district engineers are directly charged by law with the removal of wrecks from navigable channels. Sometimes these wrecks, at the time they sink, also deposit other material in the water. They are a matter of interest then to the supervisor also. The other day when a mud scow sank near West End Light in lower New York Harbor, it proceeded to drop the mud from one of its pockets. This is understandable,

much as the Irishman who fell overboard with the anvil shouted that unless someone quickly dropped him a life line he would let go the anvil. If it is possible to locate such material the responsible person is directed to have it dredged out, under proper supervision.

An amendment to the law establishing the office also charged the supervisor with the enforcement of the law forbidding fishing or dredging for shell fish in any of the channels leading to or from the harbor of New York, or from interfering in any way with the safe navigation of those channels by ocean steamships and ships of deep draft.

In 1924 Congress passed a law called the Oil Pollution Act. This forbade the discharge of fuel oil in any form into navigable waters under the jurisdiction of the United States. In common with other governmental agencies the supervisor is required to enforce the provisions of the Oil Pollution Act. However, any violation of that act in the waters under the supervisor's regular jurisdiction is also a violation of the basic law which established the office. In submitting complaints to the United States attorneys, for actions to be brought against offenders, it has been found better to submit them all under the basic act as amended from time to time.

Since the establishment of the office, the various supervisors have sent some seven hundred cases to the United States attorneys. Of that number more than five hundred have resulted in convictions, or settlements to the advantage of the United States, and to the financial cost of the offender. There are still a considerable number of cases pending.

It should also be remembered that the interests of the United States are more often protected by other action than sending cases into court. For example, the regulations of the supervisor's office, under which permits to move refuse material are issued, require that no spiles or other heavy wood be included in the loads to be dumped at sea. This is to prevent stove-in vessels and broken propellers. Patrol boats send back barges that have spiles of wood in them, and require that such wood be removed before the barges are allowed to proceed to the dumping grounds at sea to the southeastward of Scotland Lightship. This entails a loss of time for this expensive equipment, tugs and barges, and is action that the companies concerned desire to avoid. They can avoid it by complying with the law and the regulations under which the permits are issued.

Not long ago two deck scows, loaded with sand and gravel, turned over after being run into while secured in Gowanus Creek, which is part of New York Harbor. The parties concerned were informed by the supervisor that they would be expected to dredge out the material thus illegally deposited, and that they would be allowed thirty days in which to comply. The alternative, of course, would have been to go to court. The owners of the barges had the material dredged out to the satisfaction of the district engineer's inspectors (who cooperated with the supervisor), well inside of the time limit.

It is a fact that many infractions of the law occur, not because the responsible owners or operators desire it, but because the crews are either inefficient, disobedient, or stupid, or the material equipment fails in some way. Excuses are not accepted where there has been any considerable illegal deposit. There are cases, however, where discretion must be exercised by the supervisor in order that substantial justice shall be done. Where the actual damage has been small, and from previous records it is manifest that the offender has tried to comply with the law, first offenses are not always sent to the United States attorney.

The permits required from the supervisor's office before any dredged, excavated, or refuse material can be moved by water, together with reports of loading, and inspections and reports by the patrol boats and inspectors, constitute an efficient cross-check system. Permits are required to be returned promptly if not used. If used they are collected by a patrol boat, suitably endorsed, and returned to the office. Concerns given so-called continuous permits, good for fifteen days, are required to submit daily reports of loading of their scows. Water-front inspectors submit reports, as does the harbor patrol boat *Vigilant*. Reports are made by the other patrol boats, one stationed near the Narrows, and one near the dumping grounds. Reports are received also from Scotland Lightship.

These reports are all recorded and compared in the office to see whether the material is accounted for from point of loading

until point of legal deposit is reached. It is interesting to see what an accurate record results from all these inspections and reports, and how promptly instances of illegal deposit, popularly referred to as "short dumping," are brought to light. When such a violation becomes apparent the supervisor writes a letter to the offender telling him what appears to be the case against him, and asking him for any statement he may wish to make before further proceedings are instituted. Usually these cases must be sent to the United States attorney for action after the offender has been heard.

It must be remembered that it is to the interest of all contractors that none of them be permitted to indulge in short dumping with impunity. Such procedure would give him an advantage over his competitors in bidding for contracts, so any one tempted to dump short would be deterred by the thought that the supervisor's office has the interested coöperation of his competitors.

The basic law provides that for information leading to a conviction one half of the fine may be paid to the informer. While payments have been made under this provision, they have not been many, and in general the supervisor's office has to rely principally upon the reports of its own patrol boats and inspectors. Occasionally it has the assistance of other government agencies, such as customs guards.

One night not long ago a customs roundsman heard a suspicious noise of repeated splashes near a certain steamer. He investigated at once and found that a deck hand was busily throwing overboard the rubbish from the holds that had been cleaned out. About six tons of this material had already been deposited in the water of the harbor. The company owning the steamer is now involved in court action. The minimum fine was not accepted in settlement of such calculated and considerable violation, evidently authorized by agents of the company of sufficient rank to have known better and to have appreciated how reprehensible such procedure was.

In performing the regular duties of the supervisor's office there are various interesting and useful by-products, if they may be so referred to. Life is not infrequently saved by the patrol boats. Three lives have been saved in the last six months. One of these was that of a scowman on a scow which sank in lower New York Harbor. He is not the first scowman to owe his life to the alertness of the patrol boats.

A few years ago a pleasure sailing craft capsized in the harbor. For some time prior to its accident it had been kept under observation by one of the supervisor's patrol boats. Hastening to the scene, it rescued fourteen people from the water. Unfortunately some who had been crowded into the boat were drowned before they could be picked up. One woman who was rescued was noticed to be choking in a peculiar manner. The master of the patrol boat, with that resource which so often distinguishes sailors, sent for the chief engineer, and had him block open her jaws. Inspection by the master showed something caught in the throat of the gasping woman. He had the chief engineer give him a strong bent wire, and with it successfully extracted from the woman's throat her false teeth which in the excitement and struggle in the water she had tried to swallow.

The patrol boats not only save life, but in some instances might be said to be aids to Cupid. Not long ago the patrol boat *Lamont* came to the rescue of a young man and a young woman who were in a canoe, too far from shore, in the clutches of a strong ebb tide that was taking them to sea. Their näive explanation was that they had not noticed where they were until they had found themselves too far out. They and their canoe were safely put ashore, and each of them wrote grateful letters to the supervisor, who may be relied upon to respect their confidence.

There are various kinds of barges or scows, but the ones employed for dumping at sea are almost always of the self-dumping type. They are either bottom dumpers, or side dumpers, depending upon whether they are constructed so that the bottom opens, or the sides swing down to permit dumping. One night, in the rough sea outside, a scowman, after operating the gear to permit the bottom of a scow to open, was washed by a heavy sea over the combing into a pocket or well of the scow. He was observed by the patrol boat, which had its searchlight directed on the scow. Two members of the crew of the patrol boat *Cerberus*, at the risk of their lives, then descended into the slippery pocket and brought out the scow-

man, sixty years old, who was injured and could not help himself.

Even a more spectacular accident was that of a scowman who was precipitated into a pocket just as its contents was falling through the bottom of the scow into the sea. The unfortunate man was carried through the bottom of the scow in the midst of the débris and into the water. By a miracle he came free outside the scow, and upon reaching the surface was picked up by the patrol boat. One of the masters tells a story, which is a matter of record also, of a scow which turned over at sea, and imprisoned the scowman within it. The scow was towed back to port, the scowman having been given up as lost, after a search of the vicinity of the accident. Upon arrival in port someone heard a pounding on the bottom, and he was released, after fourteen hours' imprisonment.

The master of at least one patrol boat has by Act of Congress been awarded the silver life-saving medal of the Treasury, after a record of numerous rescues, in connection with several of which he had personally jumped overboard.

The supervisor's force has no aviation section, but upon at least one occasion it has assisted those engaged in aviation pursuits. In 1925 a parachute jumper was picked up from the water of lower New York Harbor a half mile from Staten Island by a launch of the supervisor's force. The principal duty of this launch, the *Lookout*, is the enforcement of the law against oil pollution. It regularly patrols the vicinity of the Kills bounding Staten Island on the north and west, upon which abuts the property of numerous oil companies.

Among the more unusual requests for permits received by the supervisor's office have been several for the disposition of the ashes of deceased persons whose final request was that the ashes resulting from their cremation should be cast to the winds at sea. In at least this class of cases the policy of the office has been to disclaim jurisdiction, but to write a courteous and sympathetic response.

One request for a permit was with regard to the disposition of a dead whale, and a permit was duly issued. Only the other day the captain of the harbor patrol boat reported a steer swimming in the East River. His disposition, or rather rescue, was at the time, however, being actively provided for by the owners' representatives.

The basic law establishing the supervisor's office requires for the safety of barge personnel that any barge or boat transporting material under the cognizance of that office have its name or number and owners' name painted on it in plain letters, of a certain minimum size, and that various provisions be made for the protection of life. By permission of the supervisor's office this provision is complied with by having a certain symbol letter and number painted on the vessel, these symbols being registered in the supervisor's office after approval. Each vessel must carry a suitable anchor and line, a life belt and life buoy for each person carried, and have a life line run along the side.

The supervisor of New York Harbor should not be confused with the captain of the port. Due to the similarity in the apparent significance of these two titles, considerable confusion is caused. The captain of the port is an officer of the Coast Guard, at present of the rank of captain. His office is in the customhouse, at the foot of Broadway, New York City. He is in charge of the anchorages of the port. Also he is the commander of the New York Division of the Coast Guard, and as such is in command of all Coast Guard operations in that division, including the rum chasers. Cordial relations exist between the supervisor of the harbor and the captain of the port. The latter extends coöperation to the supervisor, in that his forces are supposed to report when they witness infractions of the law with the enforcement of which the supervisor is charged.

For the particular duties of his office, in the area under his jurisdiction, the authority of the supervisor of the harbor is somewhat analogous to that of a United States marshal. He has authority to appoint inspectors and deputy inspectors for the purpose of enforcing the law under which the office operates. They are authorized to board vessels and enter premises that appear to be breaking the law, or for the purpose of making sure that the law is not being broken. Also they have authority to make arrests, and can make arrests without a warrant when an offender is caught in the act of violating the law.

While a summary arrest is sometimes made, it is the usual practice for an inspec-

tor simply to warn the offender, and require him to take such corrective action at once as may be possible. The inspector then reports the violation to the supervisor. The supervisor communicates with the offender, informing him of the reported violation, and asking for any statement he desires to make before further proceedings are taken. This reply may be made by letter, in person, or by attorney. Unless cause is shown that contrary action is indicated, the supervisor then reports the violation, with necessary information, to the United States attorney of the appropriate district, asking him to proceed in the courts against the offender.

In this way the supervisor has considerable official contact with the offices of the United States attorneys of the Eastern District of New York (headquarters in Brooklyn), Southern District of New York (headquarters in New York City), and of New Jersey (headquarters in Trenton). Not infrequently it is considered to be to the best interests of the government for the United States attorney to accept the minimum fine of $250 from the offender in settlement, and thus close the case without going to trial. It is the general rule for the United States attorney to request the supervisor's concurrence with such action in case there is any doubt in the matter.

In case a summary arrest is made, the offender must be taken forthwith before a United States commissioner, judge, or court. As the offense is a criminal one, an offender will be required by the court to post bail pending trial, or in default of bail will be kept in custody. The inspectors have the same authority to take witnesses into custody as they have in the case of offenders.

The making of summary arrests should be and is reserved for extreme cases, in which offenders adopt an improper attitude, or when it seems desirable for other important reasons. Generally such action is neither necessary nor desirable. The offenders are generally ships' personnel, or the personnel of companies or concerns with property and plants which make it certain that when required the offender or a party responsible in law and financially responsible also can be obtained. It would not be good policy summarily to arrest and remove an officer from a ship, for example, unless the provocation were great and the justification clearly apparent. Such action might cause public inconvenience and also loss to a company disproportionate to the offense committed. It will always be easily possible for the United States attorney later to libel the vessel, if such action be necessary.

Harbors of considerable size and activity are always interesting. New York is no exception. Unless one has gone around New York Harbor he cannot appreciate its diversified and interesting activities and the magnificence of its prospects. The Kills of Staten Island, with their oil plants and factories, Gowanus Creek and the Erie Basin, with their busy docks and equally busy shipyards, Newton Creek, separating Brooklyn and Long Island City, Hell Gate and its great bridge, the better known but always interesting water fronts of the East and North Rivers, with great ocean liners at the docks or entering or leaving port, the busy traffic plying the harbor, New York's magnificent bridges, including the great new Hudson River Bridge, with its gigantic piers as tall as battleships stood on end, quaint but busy Harlem River with its thirteen bridges, and the magnificent views of the masses of New York's tall buildings from various points of view, form a vital and stirring panorama of a kind not equalled anywhere in the world.

All in all, the supervisor of New York Harbor is brought into contact with many interesting phases of life. However wide his knowledge of human nature and his judicial acumen and poise, he can make good use of them. He needs some technical knowledge of a good many industries and activities in order to know in certain cases under investigation whether the best practices of those industries and activities have been followed. Naturally his nautical experience is most drawn upon, but that is by no means the whole story. It is true that he comes into contact with ship, towboat, barge, and scow companies and their personnel, both ashore and afloat. But also he deals to some extent with contractors engaged in dredging, dock and pier and bulkhead building, with oil companies, shipyards, power plants, ferries, terminals of various kinds, railroads, with lawyers, and with federal, city, and other local officials. The supervisor's contacts are many and varied. He retains touch with matters marine, with shipping in general in the various phases of its ever interesting activities.

Punishments Humanized

By LIEUTENANT CAMPBELL H. MINCKLER, *U. S. Navy*

ANY subject relating to punishments is essentially highly controversial in nature, and therefore must be approached with an open mind. I am going to give a résumé of the punishment system in the Navy as it is today, then derive the mission of punishment, and finally make certain suggestions for improvement which I believe support the mission. The subject of punishments is so broad that no one can properly cover the field in a short treatise; I have therefore had to choose from the numerous considerations available those which I believe will produce the greatest degree of disagreement in the minds of my readers, because discussion of a controversial matter is naturally more illuminating than elucidation of the obvious.

Before considering change, we must review the salient features of our system of discipline as it exists today. All these features do not exist in all commands, but they are a fair cross section of the general situation. When a man commits an offense he is brought to captain's mast after a preliminary hearing before the executive officer. The captain at mast generally sees the offender for the first time. His action may be any one of the following: he can recommend the man for trial by general court-martial; he can order that he be tried by summary court-martial or deck court; he can give him a legal mast punishment; he can warn him or excuse him. The only information available to the captain is the man's service record and the fact that he has committed the offense.

In deciding upon his course of action, the captain is generally governed by a standard, almost inflexible schedule of punishments. Men accused of crimes against nature and society are handled through the same legal machinery as men accused of purely military offenses. In arriving at sentences, general courts-martial are allowed a wide latitude, but summary and deck courts generally adjudge a sentence in accordance with a fixed schedule. This fixed schedule is merely a tabulation of technical charges with the corresponding punishment to be adjudged. Members of courts are authorized to recommend clemency after adjudging the scheduled sentence, but this is seldom done. In general, men are given standard punishments for the technical nature of the offense without regard to extenuating or aggravating circumstances.

No officer other than the commanding officer has the legal power to punish. Junior officers and petty officers do punish, but they have no affirmative legal authority to do so.

Our legal machinery is complicated and cumbersome; our procedure follows closely that of a criminal court under civil law. Officers acting as prosecutor and defense counsel are expected to display almost the same learning in legal matters as is expected of a trained criminal lawyer. The members of the court combine the functions of judge and jury.

Whatever may be the mission of our present system of disciplinary administration, it has failed to forward that mission. The result is bad, and something should be done. Just what is to be done none of us can say with certainty, but the situation surely merits our meeting it squarely and with open minds.

The motive or mission of punishment among the ancients was purely a motive of revenge. It is best illustrated by the passage from the Levitican law, "an eye for an eye, a tooth for a tooth." It is the motive of satisfaction. The man has wronged society, and society, in its anger, must seek retribution. Though this motive today is acknowledged to be wrong in principle, still we have all seen punishment inflicted for no other reason than that the punisher was angry. We have all seen punishment inflicted in a fit of anger which would not have been inflicted after mature deliberation.

Later came the motive of deterrent effect —the theory that a severe punishment will deter the offender from further crime, and will likewise deter others from similar crime. How well this motive has worked out in general is a moot question. In theory it should work out, but today we see our jails full to overflowing and crime increasing by leaps and bounds. In the Navy we see the number of court-martial convictions increasing, and the number of offenses increasing also. The overleave offender chalks up his fine as one of the expenses of the party. I do not want men serving under me who do their work and come back on time merely through fear of punishment.

Modern criminology has gone farther, and although the motive of deterrent effect persists, the more proper term is the motive of correction, that is, correction of the individual. However, if his crime be murder, for instance, he is assumed to be beyond correction and is put out of the way. This motive is still further illustrated by the increasingly prevalent "habitual criminal laws," the logic of which is briefly this: For a certain number of offenses we try to correct, but a further accumulation shows the futility of such attempts, so we go back to the motive of deterrent effect, and by putting the habitual criminal in prison for life, we permanently deter him from further crime.

I hold this habitual criminal law to be sound and to have a direct application in the administration of naval discipline. If a man commits a few military offenses, we should try to correct; failing in that, we should put him away. By "put away" I do not mean execution or life imprisonment, but simply discharge. He is thus put away permanently in the naval sense.

The mission can therefore be stated: To correct the lawless tendencies of the individual in order to make a useful man-o'-war's man of him; failing in that, to dispose of him.

Another way to state this proper aim in punishing is: "To punish in such a way as to obviate the necessity for future punishment."

Our mission naturally brings up the question, Who is competent to correct, and therefore to punish? In discussing this, it is necessary that we delve into the delegation of authority and the initiative of the subordinate, expressions which, it is hoped, describe policies which actually exist and are not, as often hinted, mere words.

There is undoubtedly at present a decided trend toward centralization in all lines of naval administration. This has been taking place, I believe, not because of a studied decision that it is all good, but rather because our modern, rapid, and efficient means of communication have made centralization easier of accomplishment. In the old Navy, the ship, once at sea, was beyond the influence of authority outside the ship. The captain was given a comparatively free rein in the manner in which he forwarded the mission. There was no one to check up his every move, and the only criterion of his manner of performance of duty was the result attained. He could punish as he saw fit. I will quote you the words of one of Paul Jones's officers in describing his captain: "I sailed in my time with many Captains, but with only one Paul Jones. He was the Captain of Captains. Any other commander I sailed with had some kind of method or fixed rule which he exerted to all under him alike. It suited some, and others not; but it was the same rule all the time and to everybody. Not so Paul Jones. He knew every officer and man in his crew as one friend knows another. Those big black eyes of his would look right through a new man at first sight, and maybe see something behind him. He knew every man and dealt with each according to his notion." How different is this idea from our present system in almost every line of naval activity, wherein everything is done at the time specified, at the place specified, and in the manner specified, and punishments are meted out in accordance with a fixed schedule. I do not contend that everything Paul Jones, or his contemporaries, did was good; all men make mistakes, and I most assuredly would not turn back the hands of time to those days of ignorance and superstition.

But how much of our progress has been real progress? How much of our studied system, schedule, organization, and fixed rule represents true gain? I see before me a vision of our fleet deployed for a great sea fight in the next war, the men at their stations, the guns loaded and laid, every officer and man at his post ready to do battle for God and Country the instant "commence firing" is received from Washington. I do

not denounce plan and schedule in general; they are functions of organization, organization is government, and without government we have anarchy. But plan and schedule are our tools, we are not theirs. When a plan or schedule fails to work for us as any good tool should, destroy it and get another. I feel that today plan, schedule, and fixed rule are being carried to such extremes that we are rapidly becoming reduced to the status of robots and yes-men. Our every move is dictated by fixed rule; we are getting more and more like the old-fashioned housewife who washed on Monday, ironed on Tuesday, mended on Wednesday, and baked on Thursday. If the family ran out of bread on Tuesday, it was just too bad; the schedule said bake on Thursday, so the family went without bread until the schedule said bake.

How much of this centralization, this schedule and fixed rule, is good and how much of it is bad?

If a piece of machinery on my ship develops a flaw, I look in the current instructions to see how to repair the damage. In the installation, upkeep, and repair of the hull fittings and machinery, I find that I have laid out for me a definite schedule or plan to follow. Those plans have been made out by those who know my hull fittings and machinery. Their knowledge is the cumulation of their own experiences and the reported experiences of others in the installation, upkeep, and repair of those identical hull fittings and machines. Every bolt and nut, every casting, is catalogued and blueprinted, the materials of which they are made are laid down in the contractor's specifications. You can classify fuel oil according to specific gravity, viscosity, and flash point; you can list ships themselves according to tonnage, length, speed, and metacentric height; but you cannot catalogue my men. The doctor may classify them according to height, weight, chest measurement, and whether or not they have their tonsils, but their moral attitudes and mental proclivities are things which you cannot classify or blueprint. All men possess certain qualities, some the milk of human kindness, some honesty, some courage, some conceit, some ambition. But in each individual the mixture is different. It may be different in the amounts of these qualities like the elements that go to make up an inorganic substance; and even if the amounts of these qualities are identical, like the isomers of organic chemistry, their relations one to the other may be so varied that the final substance is wholly different.

Thus, you who have made a study of mending cylinder heads can tell me how to mend a cylinder head of mine because it is just like the many you have mended, but you cannot tell me how to mend a flaw in one of my men, because you have never made a study of that man. You may have studied a thousand others, but this one is different.

I have stated that the doctor can classify men according to height, weight, and so forth, but we do not punish to make the short tall or the fat lean. We punish to correct a moral flaw, a mental misconception of right and wrong. All of which leads me to state a general decision under the mission of correction. *The only officer competent to correct is one who knows the moral attitude and mental proclivities of the men to be corrected; therefore, abolish all schedules of punishment and let the officer on the spot determine what is best.* It has been argued that the state of morale on board small ships is superior to that in large commands, and that this is due to the closer contact between officers and men. Just why does closer contact between officers and men produce improved morale? There are probably many reasons, but not the least of them is the fact that the captain of a small ship, knowing his men intimately, is better qualified to correct than the captain of the large ship who is punishing a man he never saw before, and whom he cannot know because the ship is too large.

How can this be accomplished? How can we find an officer competent to punish if he must be a psychoanalyst who, like Paul Jones, is able to look right through a man and see what is behind him. We cannot hope to find such an officer on every ship, but we can come closer to finding him than we do today.

With that hope in view, I submit for consideration a few suggestions designed to carry out the mission of correction. None of them is a panacea, guaranteed to cure the lame and the halt or heal the sick and the blind. I firmly believe them to be sound in principle. There are drawbacks to each, but no one can condemn any of them as you

can condemn our present system, when you say it has been tried and it doesn't work.

Delegate to division officers the power to punish for minor offenses occurring within the ship. The division officer knows his men; if he doesn't, give him a chance, but if he cannot learn, get a new division officer. Judge the division officer by the results he gets. If he does not know his men and therefore cannot be competent to maintain discipline, it will show up. You are now saying, "Surely it will work if the division officer is competent, but if not, while we are discovering his incompetence, his part of the ship is suffering. We cannot allow that." I cannot answer that contention better than a certain officer did in the course of a talk on leadership when he said, "My belief is that it is more important to train our juniors in correct principles of command than it is that the job be done right." A big advantage of so empowering a division officer is that the petty officers will have a quick, reliable means of obtaining legal punishment for men who deserve it. The boatswain's mate whose only attributes of leadership consist of a nasty tongue and two rows of knuckles can no longer say that these methods of punishment are the only expedient ones. At present, if the petty officer cannot handle a man by ordinary means, he has legal recourse only to the captain's mast, which involves delay, the attendance of the petty officer at mast when he has other work to do, and the stigma of needing the captain's help to do his job. He has illegal recourse to his fists. This last method is our recognized naval speak-easy. How many times have we heard a young officer bragging about his boatswain's mate, the one who socks 'em and rocks 'em? But, let us bring this matter away from our private conversations out in the sunlight for an airing. The petty officer who makes a practice of using his knuckles gets obedience on the spot—yes—but behind his back the men hate him. The young American of today does not do his best work under a slave driver's lash. He resents every dirty appellation applied to him and every blow he receives. Anyone, officer or man, who exacts obedience, but at the same time creates resentment in the hearts of those under him does not possess the requisites of true leadership, which produce results through understanding, fair play, and mutual respect. If we could go back to the real reasons for our wholesale desertions and our appalling number of bad-conduct discharges for absence over and without leave, I am confident that the two-fisted boatswain's mate would stand high among those reasons. He is probably keeping his part of the ship clean, but at the same time he is driving men who could be made useful over the hill to spread malicious libel about the Navy, some of which is unfortunately true. Another grave danger in tolerating this practice is that such a petty officer is, some day, going to try these tactics on the wrong man, and find himself on the receiving end. I know a division on a battleship where that happened. I do not wholly condemn such a petty officer so long as his actions receive, as they do in many commands, the silent consent of his seniors, and so long as this method of punishment remains the most expedient one. But if the division officer had authority to punish his own men for the offenses for which some petty officers abuse them, we would be removing the only justification possible for this vicious practice.

When more serious offenses are committed, those which would at present be tried by summary court-martial, the division officer should conduct a preliminary investigation of the case before it is brought to mast. This investigation should be so thorough that before going to mast, the division officer could make a report to the captain covering the offense with all attendant circumstances, and impart to the captain a correct knowledge of the merits and weaknesses of the man to be punished. On some ships this procedure or something approximating it is carried out. One answer to this suggestion is that the service record of a man gives the captain the information he should want. My rebuttal must take the form of a direct contradiction. Mathematical marks and tabulations of offenses only can be little better than meaningless in conveying a true picture of the man to be punished. I recommend the inclusion of remarks in the service record similar to the remarks entered on an officer's fitness report. By this means, any division officer who can write and knows his job can make the record mean something. The popular objection to this procedure will be that it entails too much effort. But we write reams about bolts and nuts, oils and greases, paints and varnishes, we study in-

numerable textbooks on guns and machines; haven't we a little time to devote to our men? If a division officer cannot carry out his duties toward the men entrusted to his care without neglecting his other duties, then I cannot too heartily recommend that he neglect his other duties, and perhaps let his quarterly inventory of swab handles be a few days late.

Grant to captains the same powers of punishments now held by summary courts-martial and reduce the number of courts to a minimum. Going up to mast and getting his punishment on the spot is a different thing from going through the rigamarole of a court-martial. To understand this, put yourselves for the moment in the position of a young recruit on board ship. From his story-books he has the idea that a court-martial is used only as a preliminary to being shot at sunrise. Then some older man in the division announces himself as follows: "Well, I was having too good a time to come back yesterday, so I'm down for a shoot. The old man gave me a summary." The recruit fails to see any perturbed look—you know why: it isn't there. The man getting the summary court swaggers about before the newer men as though he were proud of himself—it takes a brave man to flout authority. Then the recruit hears the account of the court and later learns that his friend was fined and restricted. "Well a court-martial isn't such a bad thing after all. Looks like a fellow has to have one to be a real sailor. This guy has one and he's a sailor. I haven't one, and he calls me a boot." Believe it or not, I have actually seen accused men in a court room enjoying every minute of the proceedings. It was the first time since they joined the Navy that so much attention had been paid them—they were the center of attraction, like the bride at a wedding, or the corpse at a funeral.

Now, suppose we change the system and our friend the recruit comes back absent over leave. His division officer sends for him, and asks him why he did it. A little tact will always bring out the true story. And instead of the pompous court-martial about which the recruit is so curious he sees at mast the captain and his division officer. The division officer has explained the result of his preliminary investigation; that is, he has imparted to the captain his knowledge of this man's make-up. The captain explains to the young man that when he overstays his liberty he is hurting himself and his chances of getting somewhere, that his work in the meantime has to be done by somebody else. The young man has a job, and how can it be done if he can't be relied upon to come back on time and turn to? Then, as an example in one type of case, restrict him to the ship for an indefinite period, until he demonstrates that he is entitled to more liberty. I'll bet dollars to doughnuts that that boy will be up to see his division officer within a week with the assurance that if he'll let him go ashore, he'll always get back on time, and furthermore, I'll lay a bet that he'll do it. There wasn't much fun for our recruit in that proceeding—he has found out that overstaying liberty isn't the smart thing to do after all, and he is just a little ashamed of himself. Is this mollycoddling? If you think it is, make the most of it. If mollycoddling will salvage some of the men who are being discharged for these offenses, and change them from liabilities to assets, I am heartily in favor of more and better mollycoddling. You can't denounce the plan anyway by merely giving it an unsavory name, and especially when the name does not apply. An earnest endeavor to get at the root of the evil by means of a little human understanding, kindness, and tact, is not included in my definition of mollycoddling.

Convene summary courts-martial or deck courts only when facts are in doubt. I cannot understand why, after reporting back absent over leave to the officer of the deck, then telling his division officer about it, admitting it to the executive officer and to the captain at mast, a man must then appear before a board of three officers convened for the purpose of hearing him tell it again, especially when the sentence the court will adjudge is laid down in an iron-bound schedule. If a man denies his guilt, but is probably guilty, convene a court to try the case. If found guilty, bring him to mast, and punish him just as if he had admitted the offense at mast. Summary courts-martial have only an imaginary power to adjudge sentences anyway, so no radical change is involved in this.

Instead of confining felons in naval prisons, turn them, upon conviction, over to the Department of Justice for commitment to a federal penitentiary and for such period of

time as may be determined by the Attorney General of the United States. We in the Navy are neither criminologists nor jailers. The handling of criminals is not our job; it is the job of the Department of Justice.

Make the punishment fit the kind of culpability. I cannot cover here all the various offenses committed by men in the Navy; I can, however, take three general types of offenders, and point out what I consider the punishments which fit the offenses. They are the over-leave offender, the bully, and the shirker. Deprive the over-leave offender of liberty for protracted periods. His offense has been the abuse of military privileges, let his punishment be deprivation of those privileges. The bully or tough needs a turn in the brig on bread and water. Being hard he needs softening, and physical discomfiture is always the proper retribution for one who likes to make others suffer. Dock the shirker's pay and give him extra duty. He has failed to live up to his contract with the government in a pecuniary sense; so let his punishment be a pecuniary punishment, more work and less pay.

Make the punishment fit the degree of culpability. What do we mean by degree of culpability, and how is it determined? Imagine a straight line representing the varying degrees of culpability and merit. At the right extreme place the point of perfect merit. There belongs the angel, the man who possesses in the superlative degree all qualities of virtue. At the left extreme is the thorough scoundrel who possesses none of them. Between these two extremes there is a zero individual, the man who is neither wicked nor meritorious, who from a purely mathematical standpoint deserves neither punishment nor reward. Such an individual may be illustrated by the cigar-store Indian, but he is perhaps better exemplified by the negro out in the sticks, who, when asked how he passed away the time, replied, "Well, boss, sometimes I set and think, and sometimes, I just set." While just "setting," that negro appears to me to be the perfect zero individual mathematically. He is disobeying none of the ten commandments. Morally he has a clear record so long as he just "sets." The instant he thinks, he leaves the zero mark and travels one way or the other along our imaginary scale. If he thinks of deeds of righteousness his place moves to the right; if he thinks of deeds of rascality his place moves to the left—we are all prone to give credit for good intentions, and discredit for bad, whether consummated or not. I am afraid that under our present system of disciplinary administration, this line does not appear as I have conceived it. It appears the same from the point of superlative wickedness to the mathematical zero, but the line from the mathematical zero to the point of superlative merit has shriveled up to a point. By this I mean that we consider offenses only in determining the degree of culpability. When a man enters the Navy, he starts at the zero mark. We do not know whether he is meritorious or culpable. When he commits an offense, his position moves to the left on our imaginary scale; he sins again and it moves still further to the left. While he is thus offending, he may be doing many meritorious deeds but they cannot change his position on the scale. He is relegated for that cruise to the class of the wicked. But is he really wicked? If we weigh against the one time in a year when he slipped the three hundred and sixty-four times that he did his job well, perhaps we can carry our algebraic analogy farther, and state that good deeds push the place of the individual to the right, and that his position on the scale is determined, not by his derelictions alone, but by the aggregate, or to state it in mathematical parlance, by the algebraic sum of all his works, good as well as bad. I shall always be a little bit skeptical about a man who has never done a wrong deed. I shall always fear that it is because he has not the requisite gumption or plain guts to consummate it, and being devoid of gumption, probably has never done a good deed either. The man who has not enough ambition to go ashore will never be absent over leave. I don't want my men to be angels, devils, or cigar-store Indians; I want men who do their jobs, display enthusiasm, and make occasional mistakes.

A New Source of American Naval History

By Captain Dudley W. Knox, *U. S. Navy (Retired)*
Secretary, Naval Historical Foundation

THROUGH purchase in England the Naval Historical Foundation has recently acquired a United States naval letter-book which is labeled as having been "Taken from the War Office at Washington, August 14, 1814."

The book comprises "Orders on service, from Commanding Officers" received by Lieutenant John H. Dent between December 19, 1803, and December 29, 1810. Only a small proportion of the letters contained in the book are of record in the Navy Department archives.

The first entry is a copy of an order for Lieutenant Dent to "go on board the *Enterprise,* proceed to and land at Malta, wait on the Governor, acquaint him with my object in coming off the Island," etc. These instructions were issued and signed by Commodore Preble on board the U.S.S. *Constitution.*

The next letter from the commodore includes an order to "keep a good lookout on the Tripoline prize and take care that the prisoners do not make their escape." This "prize" was renamed the U.S.S. *Intrepid,* and subsequently used by Decatur in his spectacular burning of the *Philadelphia,* which had fallen into hostile possession through accidental grounding near the harbor of Tripoli.

In April, 1804, Lieutenant Dent received orders to take command of the United States brig *Scourge* and "join the squadron in the blockade of" Tripoli. He was instructed "to capture all vessels belonging to the Bashaw of Tripoli or his subjects, and to annoy and distress the enemy by every means in your power." His blockading instructions were "you are not to suffer the vessels of any nation to enter, or to have commerce with Tripoli, and any vessels which may endeavor to enter that place, whilst blockaded by us, without permission from me for so doing, you are to detail and send into Malta for examination—you are to respect the rights of Neutral Nations and not capture vessels within the jurisdiction limits or under the protection of such nations."

It was soon after this that Commodore Preble began a series of five attacks in force against Tripoli, with his squadron comprising the *Constitution,* the brigs *Siren, Argus,* and *Scourge,* the schooners *Vixen, Nautilus,* and *Enterprise,* and six small gunboats. These successful operations, lasting over a period of several months, involved much fighting at close quarters.

In the autumn of 1804 Commodore Barron succeeded to the command of the squadron which continued to operate against Tripoli and Tunis. In 1805 Lieutenant Dent, then in command of the schooner *Nautilus,* was directed "to proceed immediately for Derne and endeavor to ascertain whether the ex-Bashaw and his adherents have obtained possession of that place—if they have, you will, I conceive, find no difficulty in establishing an intercourse with them. In the contrary case you will shape your course for Bomba, where according to Mr. Eaton's calculations I think it most probable that you will obtain information of him. As soon as you have established a safe and certain communication you will deliver to Mr. Eaton the two Field Pieces which you have on board, with the powder, ammunition, etc."

In consequence of these instructions the *Nautilus* arrived just in time to participate conspicuously in the dashing capture of Derne by Mr. Eaton, an old time "Navy agent." Mr. Eaton had been landed at Alexandria by the brig *Argus,* and from there had marched overland against Derne with a mixed naval and marine force, accompanied by friendly natives.

Through the illness of Commodore Barron the command of the squadron devolved upon Commodore John Rodgers, from whom Lieutenant Dent received a General Order, dated "U. S. Ship *Constitution*, Syracuse, 12th July 1805," and reading in part as follows:

An insult offered to the flag of the United States of America on the 12th of June last, near Cadiz by a British Squadron under command of Admiral Collingwood, induces me as the Commander-in-Chief of the United States Naval Forces in this Sea to direct that you do not under any pretence whatever suffer your vessel to be detained or your men taken out of your vessel without you are compelled so to do by superior

U. S. Ship Constitution
Syracuse Harbour 26th April 1804

Sir

As soon as the United States Brig Scourge is fully equiped and ready to Sail, you will proceed off Tripoly and join the Squadron in the Blockade of that place. You are to capture all Vessels belonging to the Bashaw of Tripoly or his Subjects and to Annoy and distress the Enemy by every means in your power. You are not to suffer the Vessels of any Nation to enter, or to have Commerce with Tripoly, and any Vessels who may endeavour to enter that place, whilst Blockaded by us, without permission from me for so doing, you are to detain and send into Malta for examination. You are to respect the rights of Neutral Nations and not Capture Vessels within the jurisdictional limits or under the protection of such Nations

All Suspicious Vessels which you may happen to fall in with, you are strictly to examine both with regard to papers and Crew, and suffer no Vessels to pass without first searching her between Decks. And you are at all times (as far as may be in your power) to succour, Aid and free any American Vessel attacked by the Enemy or in their possession. Should you want Money

force; in which case after having resisted to the utmost of your power, you are directed to surrender your vessel as you would to any other common enemy.

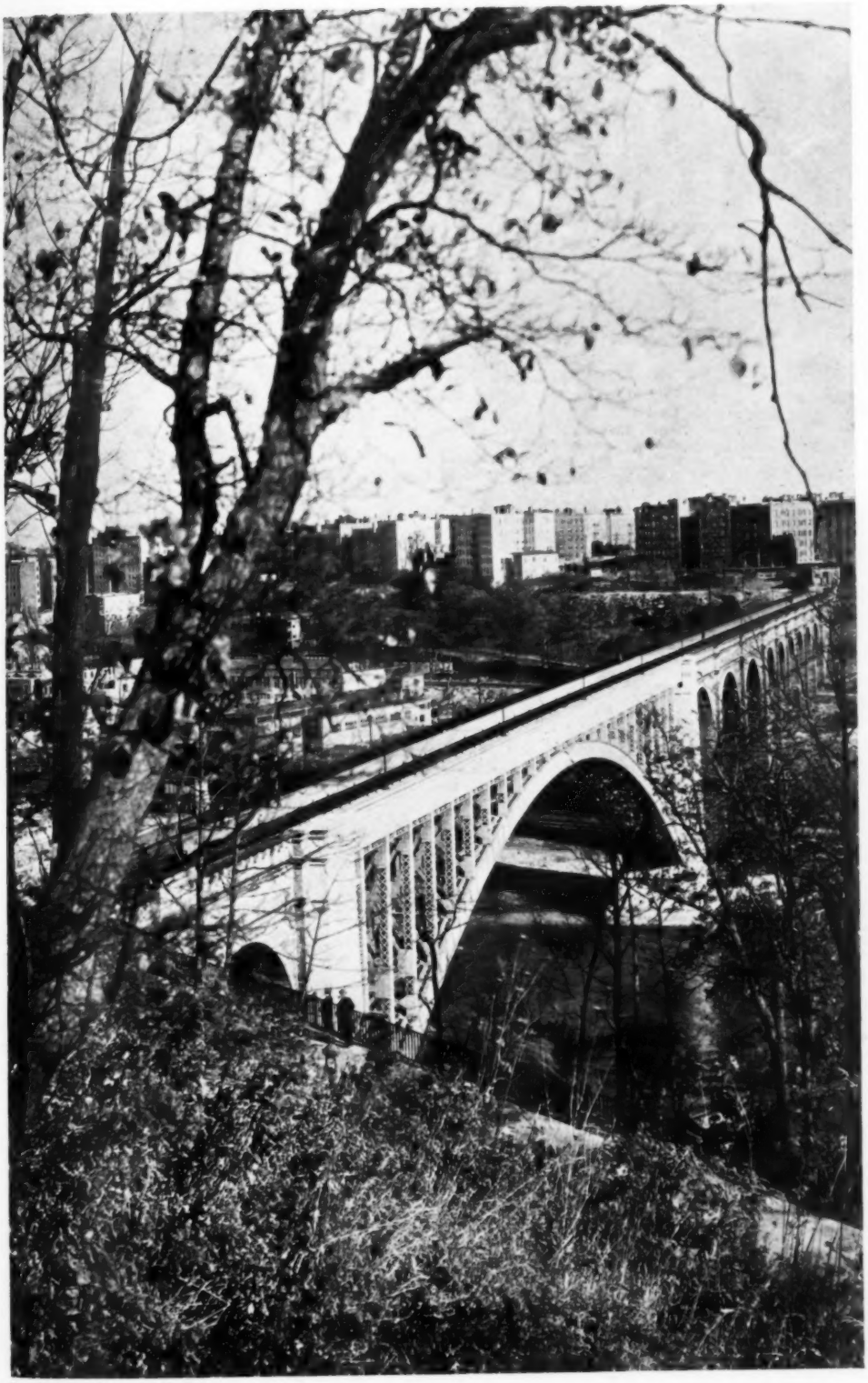
We see here a prelude of the events which led to the War of 1812.

Our long and tedious wars with the Barbary powers are too little known and appreciated. They were undertaken at the instance of President Washington who said in his annual message of December, 1796:

To an active external commerce the protection of a naval force is indispensable. . . . . The most sincere neutrality is not a sufficient guard against the depredations of nations at war. To secure respect to a neutral flag requires a naval force, organized and ready to vindicate it from insult or aggression. This may even prevent the necessity of going to war, by discouraging belligerent powers from committing such violations of the rights of the neutral party, as may, first or last, leave no other option. From the best information I have been able to obtain, it would seem as if our trade to the Mediterranean without a protecting force will always be insecure, and our citizens exposed to the calamities from which numbers of them have but just been relieved. These considerations invite the United States to look to the means, and to set about the gradual creation of a Navy.

It is thus apparent that the Barbary depredations on our important Mediterranean commerce furnished the impulse behind the very creation of the Navy under the Constitution. The subsequent employment of relatively large numbers of personnel and ships in active hostile operations over a period of years served as a baptism of incalculable value for the creation and fixation of a high standard of efficiency in the United States Navy. It was wonderful training without which the Navy could not have so distinguished itself in the War of 1812.

In obtaining the valuable old document herein discussed, shedding new light on our old naval history and traditions, the Naval Historical Foundation feels that renewed recognition is in order to the Naval Institute for the generous financial assistance rendered in the creation of the Foundation. It will be recalled that the initial contribution to the Foundation's trust fund was a sum of $1,000 donated in March, 1926, by the Naval Institute, whose board subsequently voted to give $500 additional yearly for five years. This liberality, together with donations from other sources, has made it possible for the Foundation to date to build up a trust fund of $3,000, in addition to a checking account of over $1,000.



By Ewing Galloway, N.Y.

NEW $2,000,000 STEEL AND CONCRETE SPAN OVER HARLEM RIVER, NEW YORK

This span is 426 feet long, and replaces the old stone arches which interfered with shipping on the river. It is an aqueduct for the city water system, and a bridge for pedestrians.

UNIV. OF MICH.

Doherty-Ewing Galloway, N.Y.

DOCKS AND WAREHOUSES OF THE U. S. ARMY BASE, BROOKLYN, N.Y., AS SEEN FROM THE AIR

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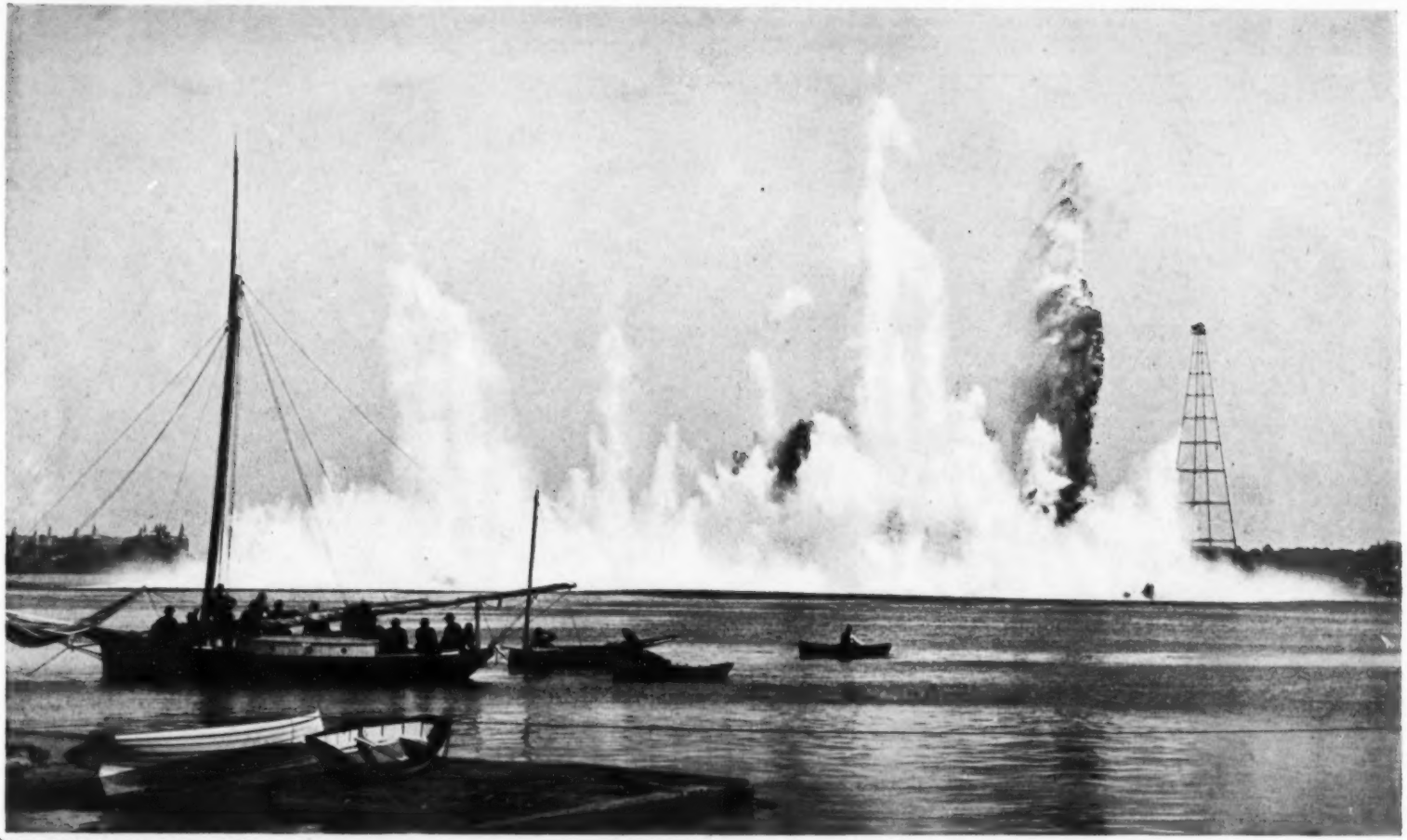

Elmendorf Photo © Ewing Galloway, N.Y.

HELLGATE EXPLOSION, OCTOBER 10, 1885

The blowing up of rocks was done to open a channel for ships.

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By Ewing Galloway, N.Y.

WHEN NIGHT FALLS ON BROOKLYN BRIDGE
This photograph was taken from Brooklyn water front.

By Ewing Galloway, N.Y.

WHEN NEW YORK HARBOR LOOKED LIKE A SILVER SEA
The view shows the upper bay and the Statue of Liberty

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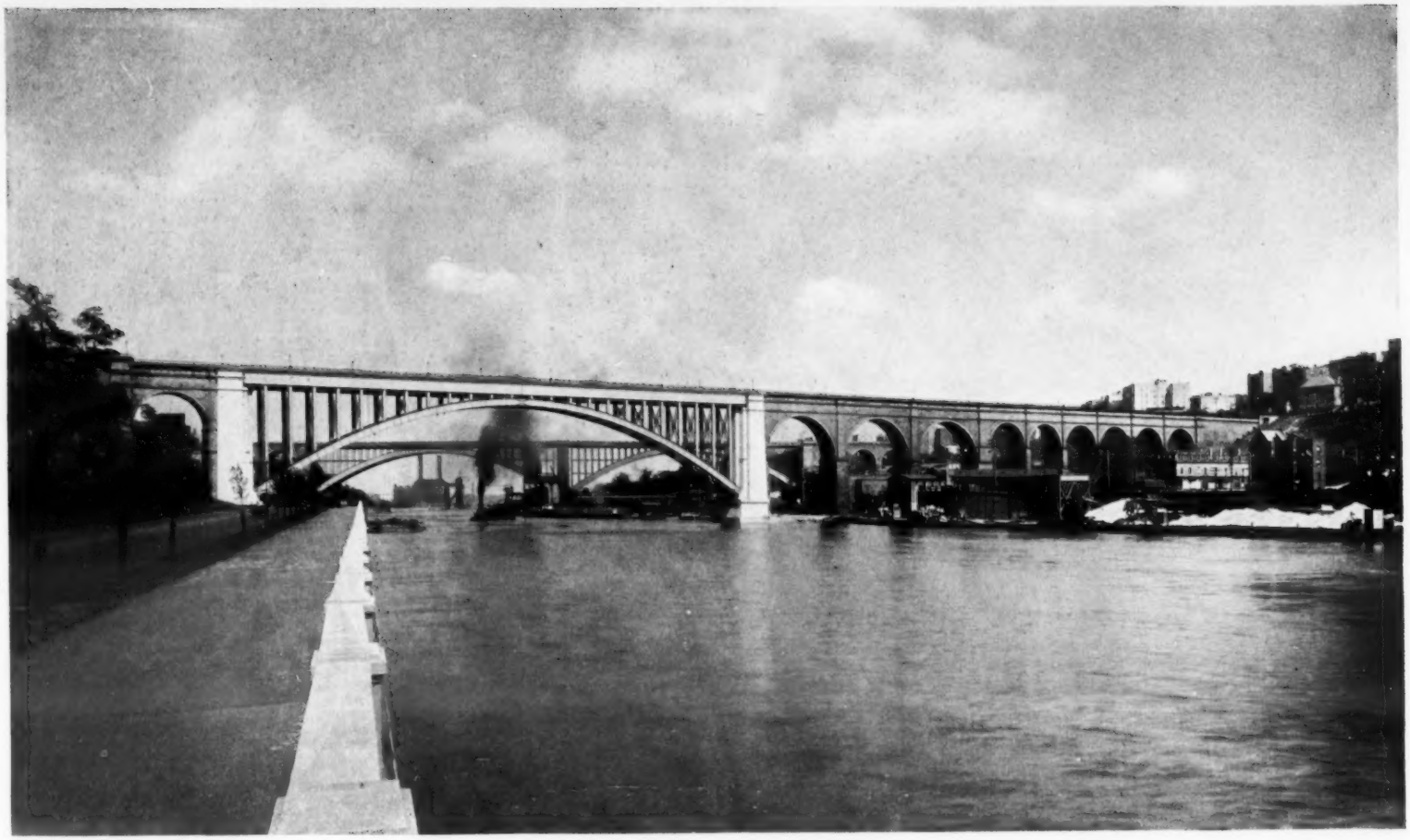


From Ewing Galloway, N.Y.

HIGH BRIDGE OVER THE HARLEM RIVER AT 170TH STREET

This view looks toward the Washington Bridge at 181st Street, and the electric power-house at 207th Street

HIGH BRIDGE OVER THE HARLEM RIVER AT 170TH STREET

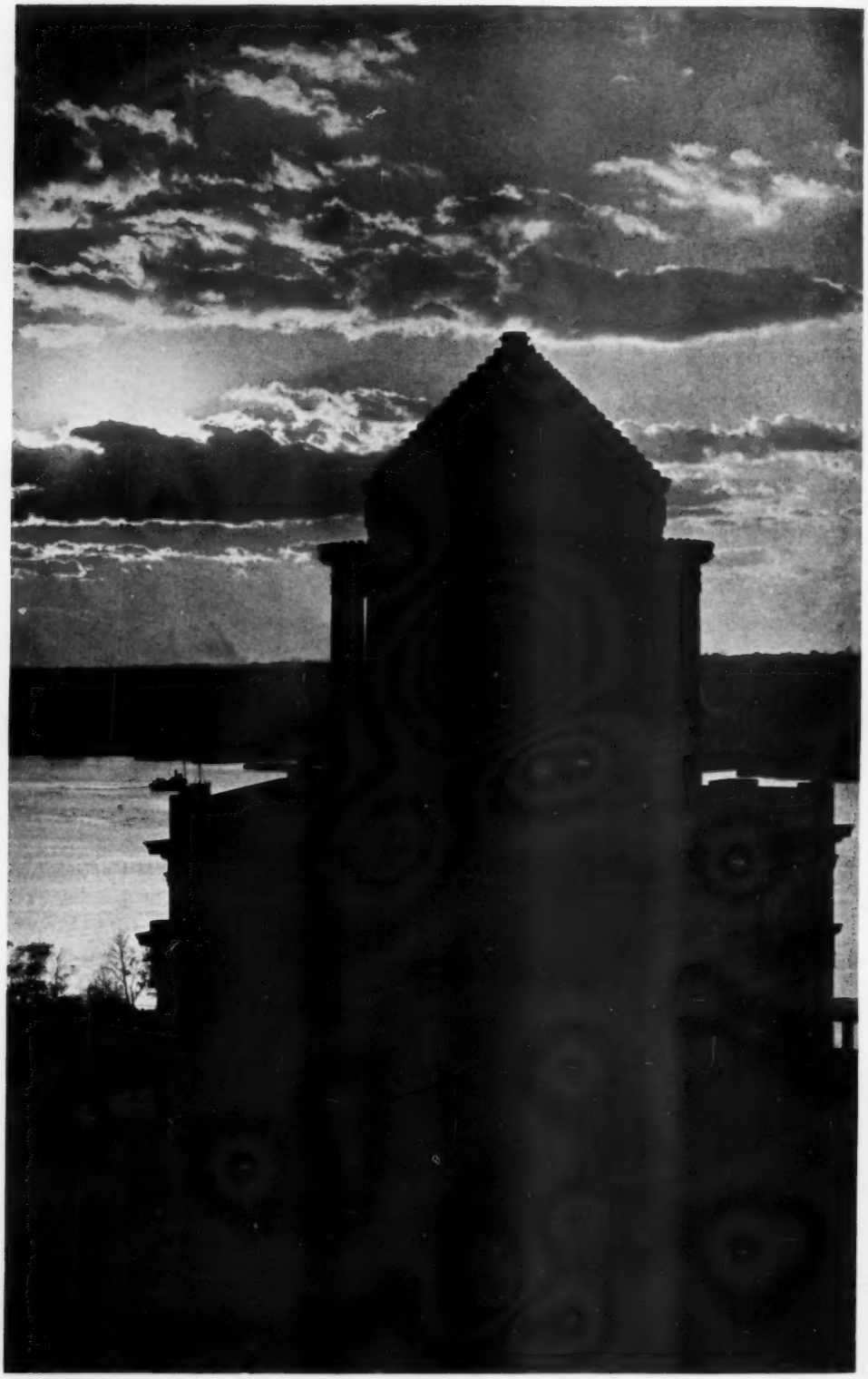
This view looks toward the Washington Bridge at 181st Street, and the electric power-house at 207th Street

By Ewing Galloway, N.Y.

HOLIDAY OUTING AT INWOOD PARK

This park is on the northern end of Manhattan Island, where the Harlem River ship canal flows into the Hudson.

UNIV. OF MICH.



By Ewing Galloway, N.Y.

GRANT'S TOMB, RIVERSIDE DRIVE, SILHOUETTED AGAINST THE LIGHT, LOOKING WESTWARD ACROSS THE HUDSON RIVER

Tsushima *and* Jutland

By Lieutenant Philip P. Welch, *U. S. Navy*

THE importance of the lessons to be drawn from the Battle of Jutland is without doubt appreciated. Hence, any study which may establish more definitely the conclusions from this battle should be of interest. Reflection on the Battle of Tsushima brings forth some striking similarities to the Battle of Jutland. By contrast, certain conditions and maneuvers, as well as reasoning by the commanders, become more conspicuous than in a study of either battle separately. As Tsushima was the first battle of modern times where fleets were engaged in the open sea, parallel lessons drawn from a comparison of it with Jutland, the only other modern fleet battle, should be of primary importance. In the following paragraphs there is submitted a review of some of the similar phases of these two battles for comparison side by side, and also a few remarks on the possibilities of a repetition of certain circumstances common to these two battles in a naval battle in the future.

The Deployments

Without going into details, the deployments and battle approaches of both battles show that the conventional drill ground set-up of forces will seldom prevail and that the least expected positions of forces are just as probable.

At Tsushima, Admiral Togo, advancing to the westward with the two divisions of six ships forming his battle line, received a signal from his third division that the Russian fleet was approaching astern of the cruiser division. Admiral Togo disregarded the signal and stood on an opposite course until he came within a range of about 14,000 yards from the advancing Russian column, when every tactical advantage, as well as his own plan of battle, demanded that his attack should be made on an easterly course. He held his course until his ships came under gunfire before radically changing course across the head of the Russian column.

This action was similar to that of Admiral Beatty at the conclusion of the battle cruiser engagement at Jutland. Admiral Beatty, after receiving a message from the *Southhampton* that the German battle fleet was in sight, stood on until it was necessary to countermarch his battle cruisers under fire from the leading German battleship divisions. Evidently it was necessary for both Admiral Togo and Admiral Beatty to sight personally the approaching enemy ships before changing course.

At Jutland, Admiral Jellicoe deployed the main body of the British Grand Fleet perpendicularly to the reported bearing of the head of the German fleet. This method of deployment has since become the recognized standard. He later changed course to the right, practically completing a "T" across the approaching German column. As a whole the deployment of the British battleship force was accomplished in such a masterly manner that it brought an overwhelming gunfire on the head of the German fleet. The result of the deployment was similar to that at Tsushima, where the Russian column was teed, although Admiral Togo's battle line was under fire during the deployment maneuvers.

Recent discussions of the Battle of Jutland in this country give but faint praise to Admiral Jellicoe in his handling of the British fleet. From a broad aspect his deployment was nigh perfect. In addition to putting the German column in the worst possible tactical position, Admiral Jellicoe was in a fine position for carrying out his strategical mission of maneuvering his fleet between the German fleet and its base. On

the other hand, great merit is often given to the brilliant German reversals of course, while criticism is seldom heard of the approach which brought the head of their column under an enormously superior volume of fire and one which eventually permitted the British fleet to get between the German fleet and its base. The approach of the German fleet in the main action of the Battle of Jutland bears a marked resemblance to the approach of the Russian fleet at Tsushima.

THE INITIAL EFFECTS OF GUNFIRE

The German battle cruisers at Jutland and later the leading German battleship divisions turned by column movement from a northeasterly course to a southeasterly course shortly after the British opened fire. This movement was not the result of any prearranged plan, nor the result of a tactical signal. The column movement was necessitated by the great superiority and damaging effect of the British gunfire. This initial movement had its counterpart at Tsushima. After the Japanese fleet completed its deployment across the head of the Russian column, it concentrated its gunfire on the leading Russian ships. The latter were forced to turn away to the eastward in order to escape from the destructive fire of the Japanese guns. Neither of these two changes of course were made in the execution of tactical signals, nor as preconceived maneuvers; they were simple movements forced upon the respective fleets by devastating gunfire. Heavy gunfire upon the head of a column, or upon a part of a fleet, will force a tactical change.

Admiral Behncke, who commanded the leading German battleship squadron at Jutland, commenting upon this phase of the battle, stated that the visibility from the German ships was very poor, that he could see nothing of the enemy, that a rain of shells was splashing about his ships, and that he consequently ordered a change of course to the right. He also commented upon the dissimilarity between the command of a fleet and of its units and that of the command of an army and of its larger units. In the latter, decisions are reached at a peaceful and commodious headquarters, far from the field of battle, after a logical estimate, which has been made from much information in a comparatively long period of time. While in the naval battle an admiral, in the midst of falling shells and the din of gunfire, is required to make immediate decisions on the bridge from his perspective of the forces engaged, decisions which will mean the difference between victory and defeat.

THE FIRST REVERSALS OF COURSE

At Tsushima, the change of course of the Russian column to the eastward caused the Japanese column to draw aft relatively. But by the use of superior speed the Japanese fleet was able again to reach a position off the port bow of the Russian fleet, and for the second time concentrated its fire on the leading Russian ships. To escape the destructive gunfire, the Russians changed course to the right. The change of course this time, however, became eventually a complete circle. This circular movement, although of large radius, resulted in a successful withdrawal from action. It was the forerunner of the well-executed reversals of course at Jutland which surprised and astounded the naval world.

The Japanese did not counter the Russian change of course by closing immediately. On the contrary, Admiral Togo in the smoke of battle and in the mist, believed that a part of the Russian fleet was attempting to escape to the northwest towards Vladivostok, its original destination. He, therefore, withdrew from the position of the Russian fleet one division by simultaneous movement and another by a countermarch, expecting to cut off the enemy from its line of retreat.

The description of the corresponding phase at Jutland is much the same. Admiral Scheer, with his column in an elbow, which resulted from the turning away of the head of his column, executed the first of his famous reversals of course by evolutions of individual ships, which withdrew his fleet from action. In the opposing British fleet, Admiral Jellicoe, catching only occasional glimpses of ships of the German battle fleet, was unable to distinguish the maneuver made by the latter. By practically identical reasoning as that of Admiral Togo at Tsushima, he gave up his greatly superior tactical position by changing course by divisions to the southeast in order to place his fleet across the eventual line of retreat of the German fleet.

In these comparative parts of the two battles it has been shown that both inferior fleets successfully retreated by reversals of course, and that the two superior fleets lost contact for considerable periods of time. Furthermore, sound tactics required the commanders in chief to close with the superior fleets in order to destroy the enemy, but both withdrew to attain a strategical position. Both commanders in chief permitted strategical considerations to interfere in the solution of a tactical situation.

The Second Reversals of Course

Admiral Togo at Tsushima, having lost touch with the Russian fleet, proceeded with his two battle divisions to the westward, crossing the line between the Russian fleet and Vladivostok. Failing to locate the enemy fleet, he reversed course by divisions. Steaming to the eastward he came upon the Russian fleet on his starboard bow. The Russians had completed their first circular movement and were again on a northerly course. The Japanese battle force was soon in its former position across the Russian course, and once again poured a devastating fire upon the Russian van, forcing the latter to turn away to the southeastward. Admiral Togo, realizing that the Russian fleet had suffered great damage, did not close the retreating enemy, but withdrew to the northward to ascertain the fighting condition of his ships. This breaking off of action caused him to lose contact for the second time. He later regained touch by steaming on a southerly course; but this time the position of his fleet was to leeward and on the opposite side of the Russians from their base. His fleet was literally encompassed with smoke, and he failed to detect that the Russian fleet had completed a second circular movement. The circle completed by the Russian fleet put them again on a course to the northwestward toward their destination, and it caused the Japanese main body, which continued on a southerly course, to lose contact for the third time during the battle.

In the description of the corresponding section of the Battle of Jutland, the German fleet completed a second reversal of course and stood head on toward the British line. This time their position became even less tenable than before. For the third time Admiral Scheer executed a simultaneous 180-degree turn by ships which, in conjunction with a well-timed destroyer attack and smoke-screen, once more extricated his fleet from probable destruction by British gunfire. So effective was the smoke screen in the mist and fast failing light that Admiral Jellicoe knew only that the German major ships had disappeared. In accordance with the British preconceived battle plans, Admiral Jellicoe, fearing a snare, did not close the enemy, but turned away to avoid the German torpedo attack, and thereby lost contact, never again to bring the German fleet under fire by his battle line.

Here, once again, gunfire had forced the weaker fleets to escape by wheeling around, and once more neither of the opponents had closed. The Japanese had lost contact, regained contact, and lost it for the third time. Likewise at Jutland the British had lost contact but for the second and final opportunity. The Japanese were fortunate in meeting their enemy comparatively early in the day, hence they could afford to batter the Russian fleet as a cat plays with a mouse. On the other hand the British were prevented a third chance by darkness.

Many are under the impression that the individual ship movements and direct withdrawals from action, as executed at Jutland, were innovations. Yet at Tsushima, Admiral Togo with the first Japanese division of six ships twice reversed course 180 degrees by two simultaneous maneuvers of ships left 90 degrees. However, without belittling the great victory of the Japanese, or giving credit for the exercise of any tactical skill to the Russians, the fact remains that the Russians in a column formation, if it may be called such, twice successfully retreated from bad tactical positions by the execution of two complete circular movements. In effect, did not the Germans make two circular movements which withdrew them from similar desperate positions?

The daring tactical maneuvers of the German fleet at Jutland surprised and secured the admiration of all. Yet, since the war, it has been learned that these maneuvers were assiduously practiced and rehearsed prior to the battle. A detailed study of the Battle of Tsushima brings forth so many striking similarities that it is a question just how much the maneuvers at Tsushima influenced the Germans in their tactics and plans of battle.

THE WITHDRAWALS AT SUNSET

Admiral Togo, at Tsushima, failing to regain contact with the Russian main body on a southerly course, changed course to the north-northwest. An hour and a half before sunset he sighted the Russian ships and brought them under fire; however, visibility for the Japanese was obscured again by smoke from the Russian ships. For the fourth time the Japanese battle line failed to bring the Russians to close quarters, but kept up a desultory fire until a half hour before sunset. At this time Admiral Togo with his major ships broke off the engagement and retired to a rendezvous to the northward, placing his fleet between the enemy and its base.

Admiral Jellicoe, at Jutland, failing to sight the German fleet, turned in general to the southwestward and westward in pursuit of the retiring German fleet until approximately an hour after sunset, when he decided to withdraw to the southward, where he thought that he would be in a position to renew the engagement at daylight. Thus again the decisions of Admiral Togo and Admiral Jellicoe were identical.

THE LIGHT FORCES

During the World War and in the succeeding years, the achievements of the auxiliary forces, and the publicity which has been attached to them by the several limitation of arms conferences, have been greater than at any period of history. False values therefore are apt to be created for these important but, nevertheless, auxiliary arms, including the cruiser, destroyer, submarine, and aircraft. In view of this it is especially interesting to review the use and effect of the auxiliary forces in the Battles of Tsushima and Jutland.

Four divisions of small or light cruisers, a total of sixteen, and about forty torpedo boats, exclusive of five flotillas which joined for the night attack, comprised the Japanese light forces actively present during the day action at Tsushima. These ships were directly attached to the three main squadrons in the fleet organization. Two of these squadrons would roughly correspond to what is our battle fleet and the third to our scouting fleet.

Admiral Togo's battle plan required the two battle divisions and the four cruiser divisions, each with their attendant torpedo boats, to close the Russian fleet between them, the battle line to form the northern jaw of a vise, the cruiser divisions the southern. The torpedo boats were to trail their respective divisions until ordered to attack. The plans finally called for all torpedo vessels to follow up the day action with concentrated night torpedo attacks.

An analysis of the battle shows what was accomplished by these fifty-six auxiliary vessels. During the first thirty-five minutes, when the opposing main bodies were engaged in the decisive period of that battle, the light forces did not fire a shot or a torpedo. The cruisers were not in the proper place at the proper time. It is a difficult job to coördinate the movements of light forces relative to and in coöperation with a maneuvering battle line against a maneuvering enemy. A time study of the fire of the Japanese cruiser divisions demonstrates the poor results attained in coördinating their fire with that of the battle line. For instance, two of the four cruiser divisions did not fire a shot until two hours after the battle lines had opened fire. The Japanese third and fourth cruiser divisions were engaged about 40 per cent of the period of the day action, the sixth cruiser division about 15 per cent of the period, and the fifth for about fifteen minutes. Thus, because of the lack of coördination and coöperation between the Japanese cruisers, the ten Russian light cruisers throughout the day action had approximately an equal fighting strength. When the Russian fleet commenced its second large circular movement, it was absolutely blocked in by the Japanese battle divisions to the north and the four Japanese cruiser divisions enveloping them on the south. Yet the reversal of course by the Russians threw both the Japanese battle line and cruiser divisions together to the southeastward and allowed the Russians a free avenue of escape to the northwestward. The Japanese torpedo boats trailed the battle divisions and cruiser divisions to which they were attached and did not at any time deliver an effective attack, except for several attacks on damaged ships which were already *hors de combat*. The Japanese light forces, after the battle had begun, also failed as scouts; Admiral Togo received no information from them. Although the Japanese superiority in light forces was enormous,

this advantage was practically of no value in the decisive periods of the engagement.

At Jutland there were some 186 subsidiary vessels on both sides. After the commencement of the major engagement, the light forces, except in one or two isolated cases, signally failed in the service of information. The British light forces, especially, emulated the Japanese destroyers in their trailing tactics. In the German fleet the doctrine for destroyers, and the relation of the destroyers to the fleet as a whole, was understood to a greater extent. On several occasions the German light forces were given missions which they carried out intelligently and evidently with knowledge of the effect of their action on the engagement. But, considering the number of light forces present and the great offensive power which they represented, the effect of their fighting strength was nil. The little damage inflicted by them was truly remarkable; only one capital ship in the day action was torpedoed, and this ship maintained her position in the battle until after nightfall. The actions between the light forces were no more than small mêlées, which had no bearing on the outcome of the battle. They played decidedly minor roles, with the single exception that the threat of the German destroyers, like the bark of a dog, was the immediate cause of the vital turn away of the British fleet.

In the naval battle the light forces meet first, engage each other, attempt to deliver their offensive power, then as the battle lines close, the light forces clear the field before those major units which are able both to give and also take telling blows. If the effects of the light forces at Tsushima and at Jutland can be used as a criterion, the battleship will remain the decisive factor of naval power for a good many days to come. The little damage inflicted by light forces in these two battles should certainly prevent a false valuation of the offensive power of auxiliary units, whether they be cruisers, destroyers, submarines, or aircraft. During numerous periods our fleet has been short of certain auxiliary forces, but the limited amount of money has always been made available for the construction and repair of battleships. The strength of our Navy has been maintained largely by the wisdom of those in control, who have resisted successfully all pressure which has been brought to bear to break the backbone of the fleet.

The Night Attacks

At Tsushima, about an hour and a half before sunset, Admiral Togo ordered all torpedo boats to attack the Russian fleet, a total of five destroyer flotillas and ten torpedo-boat flotillas, sixty-one vessels in all. The night was clear and the approximate position of the enemy was known to all at sunset. The course of the enemy's major ships was limited to a northerly direction toward one port. A night search and attack problem could not be made any simpler.

Of the total number of vessels which proceeded to the attack, one destroyer flotilla, four torpedo-boat flotillas, and four other boats failed to make contact with the Russian ships. All in all, twenty-eight boats, a percentage of about thirty-nine, were thus eliminated from the attacking force. In nearly all cases the contacts were made possible by the use of searchlights by some of the Russian ships. Five of the Russian ships were not attacked, their escape during the night being attributed to the fact that they kept darkened.

The night attacks lasted about two hours, commencing shortly after eight o'clock. In practically all instances they were directed against those Russian ships which had turned on searchlights and which had endeavored to repel the attacks by gunfire. The attack of greatest intensity was made between nine and nine thirty by six flotillas, comprising a total of nineteen boats, in succession. Approximately one hundred torpedoes were fired in the night attacks at point-blank range and seven hits were made. Two Russian battleships and one armored cruiser, all previously slowed in speed by gunfire, were sunk or so badly damaged that they sank the next day. Six of the attacking Japanese ships were put out of action by collisions, one destroyer sinking.

At Jutland, Admiral Scheer at sunset, similarly to Admiral Togo, ordered all German destroyers to attack. Without going into details, their attack never developed. Their contacts usually were made on British light forces by whom they were driven off. Their failure is apparent in the fact that no British capital ship was located or attacked during the night. The German light forces

fired fourteen torpedoes at British light forces with no results.

Admiral Jellicoe did not give orders to the British destroyers to attack, but he required them to take position astern of his fleet. During the several engagements between the British light forces and German forces throughout the night, the British light forces fired some fifty torpedoes, made five hits, and sank one German predreadnought, two light cruisers, and one destroyer. In the course of the night three British destroyers collided, one sank, one was severely damaged, and one was slightly damaged. Two British destroyers collided with enemy ships; one sank and the other was badly damaged.

The conclusions drawn from the results of the night phases of these two battles necessarily should be given great importance in the study of night tactics. In both battles forces which remained darkened escaped serious attack. On the other hand the use of searchlights and gunfire attracted the searching vessels. The two night search problems could not be considered difficult, yet the results obtained in locating the objectives were extremely poor. In both cases confusion existed and collisions occurred. The percentage of collisions in the future may be anticipated to be more than 5 per cent of the attacking light forces. If the night actions of these two battles can be used as examples to indicate the difficulties of night searching, the probabilities of making torpedo hits, and the percentage of collisions to be looked for, the results to be expected in any future night actions by light forces will seldom be overestimated.

THE WEATHER

Probably the most outstanding common characteristic in the descriptions of these two naval battles is the reiteration of the weather conditions. Time and time again weather is mentioned, including light, mist, haze, wind, sun, smoke, and darkness. As the size, power, and capabilities of our ships increase, it is believed that many unconsciously belittle the importance of the effect of weather conditions upon naval operations. They are inclined to believe that the importance of attaining the weather position belongs only to the era of sailing ships. Yet, both at Tsushima and Jutland, physical conditions made possible the escape of the two weaker fleets during the first day of battle. Instead of the tactical importance of weather considerations waning with time, it actually increases many-fold; for instance, think of the effect of wind, mist, clouds, rain, and light upon the operations of aircraft, or of the effect of rough seas upon the movements of submarines and other light craft, or of the effect of poor visibility upon long-range gunfire. If at Tsushima and Jutland operations of the first magnitude were decided by weather conditions, is it not probable that such will be the case in any future naval battle?

TOGO AND JELLICOE

Neither Tsushima nor Jutland produced a genius of the Nelsonian type. The greatest failure of the commanders in chief of the victorious fleets in these two battles was that they failed to follow up resolutely the retreating enemy fleets. Both were acting on the strategic defensive; both were imbued with the idea of cutting the enemy off from its base. At Tsushima, Admiral Togo had from ten minutes past two, when the main bodies first engaged, until sunset, a period of five hours and twenty minutes, in which to annihilate the Russian fleet. During this period the Japanese battle line was out of action two hours and twelve minutes, more than 40 per cent of the time. The Russian fleet was badly beaten, but at nightfall it was still a considerable force in being. At Jutland, Admiral Jellicoe was less fortunate; his main fleet first opened fire on the enemy main body about two hours before sunset, and under much worse visibility conditions. Analyses of the two battles have shown that both commanders adhered to preconceived plans of battle. Admiral Togo, step by step, carried out the progressive stages of his battle plan, when he might have completed the destruction of the enemy battle line during the first day by a more vigorous action. Likewise Admiral Jellicoe held rigidly to a previously prepared plan which emphasized security. Napoleon Bonaparte once remarked that the enemy drew up plans the day before the battle, when they did not yet know his movements, or what positions they would have to occupy. At Trafalgar, a battle plan perfect in principles had been previously formulated, but Nelson recognized when the time came to discard the plan in order to strike the decisive blows.

Epilogue

Between Tsushima and Jutland was a mere twelve years; between Jutland and today is an approximately equal length of time, an infinitesimal period of history. Yet is there not the inclination to look upon Tsushima as an ancient battle? May we expect the advance in the application of tactics between Jutland and today to be relatively much greater than the advance between Tsushima and Jutland? Where the Germans and the British had the successes and failures of one modern naval fleet battle to analyze previous to Jutland, are there not two now? Because of the fact that these two battles have so much in common, should not similar conclusions drawn from both battles be given even more consideration than those from either singly?

"Heaven gives the laurels of victory to those only who keep themselves in training in time of peace, and *win the battle before it is fought.* Heaven likewise takes away the crown of victory from those who soon grow satisfied with a few victories, and allow their activities to relax in time of peace. The ancient sage says, 'Tighten your helmet string after a victory!' "—Heihachiro Togo.

Are We Raising *a* Frankenstein?

By CAPTAIN FRANK JANSEN

Lecturer in Navigation and Nautical Astronomy,
University of Southern California

EXPERIENCE has shown that whenever man has invented a new machine he at the same time has been compelled to train men to operate it. When the airplane became a practical means of transportation, schools to teach men how to fly sprang up all over the country. Soon it was found that some of these schools had very low standards and were less interested in teaching the student how to fly than in taking money from him. This condition induced the federal government to step in and set certain standards for flying schools, which made the school a government-accredited institution and gave the prospective student thereof a guaranty that he would receive a thorough training. Now the student of flying has no trouble in choosing a school, knowing that it is in a position to give him the proper instruction, if he sees to it that the school he attends is under government supervision.

It is surprising to note in what short time the federal government has taken steps to help the students of flying to obtain a proper training, while on the other hand this same government has never taken the slightest interest in giving the men who are to be put in charge of our merchant ships, and who have a far greater responsibility placed on their shoulders, an opportunity to acquire the proper training which will fit them to become officers and captains.

It is this condition which has made us ask the question: "Are we raising a Frankenstein?" Are we spending millions of dollars of the taxpayers' money to create a merchant marine and not one single cent to give the men who are to be put in charge of this merchant marine the proper training so they can run the ships efficiently and be in a position to compete with the officers of foreign merchant ships? To answer this question let us see what the government has done in regard to our merchant marine, and the training of its officers.

The federal government through the Shipping Board has been spending millions of dollars a year in its endeavor to upbuild the American merchant marine. A year ago Congress passed the Merchant Marine Act of 1928, the purpose of which was to help develop shipping under the American flag. This help was given by making loans for ship construction, at the favorable rate of 3⅜ per cent per annum. How generously the government has spent money in its effort to create an American merchant marine which would compare favorably with the merchant marines of the great European nations, is well known to every taxpayer. The results obtained as compared to the vast amount of money spent are nothing of which to be proud. Now how much of this money appropriated to build up an American merchant marine has been used in training the men who are to be put in charge of the ships built with the taxpayers' money? The answer is *"Millions for ships but not one cent to train officers!"*

It may surprise most persons who know something about our educational system and the tremendous amount of money spent to give our children a free and adequate education, that at the present day there does not exist any school run under federal or state supervision where the future licensed marine officer, who is to be put in charge of the ships of our merchant marine, can obtain the proper scientific education to enable him to navigate these ships efficiently.

To fully understand what the absence of proper schools to train our licensed officers means, let us examine what qualifications are necessary to become a licensed officer in the American merchant marine, and how

such qualifications are acquired. I shall give only the requirements necessary to become a licensed officer of ocean steamers, as these are the men who are put in direct competition with men in charge of foreign ships.

To pass, for example, for a license as chief officer of ocean-going steamers, the applicant, after having shown that he has the prescribed practical experience, must successfully pass an examination in the following subjects:

1. Latitude by Polaris.
2. Latitude by reduction to meridian (sun or star).
3. Longitude by chronometer (sun or star).
4. Ship's position by line of position.
5. Ship's position by dead reckoning.
6. Azimuth by altitude of sun or star.
7. Chart navigation.
8. Time of high water by tables.
9. Speed by engine revolutions.
10. Distance off a fixed object.
11. Change in draft due to change in density of water.
12. Signaling by semaphore.
13. Stowage.
14. International code of signals.
15. International Rules of the Road.
16. Life-saving apparatus.
17. Magnetism, with regard to ship's compass.
18. Ocean winds and weather.
19. Instruments and accessories used in navigation.
20. Aids to navigation.
21. Seamanship.
22. Temporary repairs to hull and equipment.
23. Ship's sanitation.
24. United States navigation laws.
25. Rules and Regulations of the Board of Supervising Inspectors.
26. Such further examinations of a non-mathematical character as the local inspectors require.

One can readily see that to pass this examination demands a considerable knowledge of a great number of subjects. Where has the present-day officer, in charge of our ships, acquired this knowledge?

(1.) He may be a naturalized citizen who has attended a nautical college in Europe and now, after having become a citizen, goes up for the American license.

(2.) He may be a graduate of the New York or Pennsylvania state training ships.

(3.) He may have attended some nautical school run by a private individual.

It will now interest us to know what these different kinds of theoretical training are worth. The man who has obtained his training abroad is, as a rule, a well-trained man and will be an asset to his profession. The writer of this article has taught in the leading private nautical school in New York City and prepared hundreds of foreign licensed officers for the American examination and while so doing, ascertained that these men were highly trained and needed very little coaching to pass for the American license. The man trained in the New York or Pennsylvania state training ships is one of the best trained men we have in this country. But only a small number of men can obtain their training on board these school ships.

Schools run by private individuals are the source from which we obtain the majority of our licensed men. A man has gone to sea without, perhaps, at first having the intention of becoming a licensed officer; then, after some time he becomes interested in his work and after two years of sea experience makes up his mind to go up for a license. As he must become proficient in the science of navigation and related subjects before he can go up for an examination for a federal license, he will search for a school where he can receive the proper theoretical training. He will soon realize that there are any number of public schools in the country which will teach him any trade under the sun, free of charge and with very little red tape involved, but not one single public school where he can take a course in navigation, nautical astronomy, or the other subjects which are so essential to him in his future profession and a knowledge of which will enable him to pass the federal examination. The only schools he will find are schools run by private individuals who will charge him from $50 to $200 for a course, guaranteeing him to pass the examination. As the person running the school is compelled to make a living from the proceeds thereof, it is to his interest to get the student through the school in as short a time as possible. For this reason he will teach only the essentials to pass the federal examination. In most of these private schools the

teaching is done in a parrot-like manner; the student is shown a problem, told that if he adds *a* to *b* he will get *c* and then by looking up *c* in a certain nautical table he will find the answer. By working a great number of such problems mechanically, he becomes quite proficient and after a number of weeks will be able to solve even complicated problems rather rapidly, but will never know what it is actually all about. When something goes wrong with his solution, he cannot help himself nor find the reason why it did not work out properly by the mechanical rule he has learned. One of the most important subjects in which the future officer should acquire proficiency is the application of the International Rules of the Road for prevention of collisions at sea. This subject as a rule is not taught at all, but instead, to save time the future officer receives a copy of the *Rules of the Road at Sea* and is told to learn it by heart. What the spirit and interpretation of the different articles contained in this law are, is never explained to him and he goes to sea never really understanding this most important subject. To illustrate this, I may mention here the case of a captain with whom I sailed on a tanker, towing a very large oil barge between New York and the Gulf ports. Although he had been master on this run for almost ten years, he always carried the incorrect masthead lights at night because he could not properly interpret article 3 of the International Rules.

So on the whole, we may state that the private institutions to which the great majority of the future licensed officers must turn to obtain the necessary knowledge, do not give their students any kind of educational foundation with the help of which they could improve themselves while at sea, but only teach them in a mechanical way how to solve the different problems involved in finding the ship's position at sea.

From the foregoing we see that with the exception of men who can obtain their training in the New York or Pennsylvania state training schools, the majority who intend to become licensed officers on American merchant ships have no opportunity whatsoever to acquire the proper scientific training so necessary for their profession. ***The government of the richest country in the world, having the second largest merchant marine, does not spend one single cent for the education of the men who will be put in charge of its merchant ships.***

To demonstrate how serious the lack of proper training has been considered by some of the large steamship companies, it has been seriously suggested to place naval officers, who have been trained at Annapolis, in charge of our large transatlantic liners. The person who suggested this forgot that although the naval officer has received a training which compares favorably with that of officers in any foreign navy, yet as a naval officer he has never been trained to run a merchant ship, on which he has one-third the number of men that a similar sized ship in the Navy would have and where he must possess a thorough knowledge of the handling and stowage of cargo, looking after the welfare of the passengers, etc. As far as I know, this plan was dropped for fear of creating too great an antagonism among the licensed officers of the merchant marine.

Now how can these incredible conditions which now exist be remedied, and how must we proceed to enable the future licensed officer to obtain the proper technical training and give him the same opportunity for acquiring the education so necessary in his future profession that every other citizen in the United States has?

To change the above described conditions it would be best to fall back on the experience gained by other maritime nations in establishing nautical colleges and in training the officers of their merchant marine. The country which would best compare with the conditions existing in the United States is Germany. Germany has a confederation of states similar to our own United States. Only a few of these states border on the ocean, while the greater number of them are situated inland and have no direct connection with the sea. Although Germany has a population of only about 65,000,000 and a merchant marine about one-third as large as our own, there are ten nautical colleges located in that country for the training of licensed deck officers. Each of these colleges is maintained by a state bordering on the North Sea or the Baltic, but the examinations for licenses, which are held at regular intervals at each of these colleges, are in charge of the federal government in Berlin, from which the head examiners as well as the examination papers are sent.

The tuition fee for attending these colleges is nominal, amounting to about $25 for a course. The duration of a course for "chief officer any tonnage any ocean" is sixty weeks, while that for "master any tonnage any ocean" is forty weeks. Although these nautical colleges are maintained by the individual states, yet they are under supervision of the federal government in Berlin and are so held to a uniform standard and efficiency. A similar arrangement could be brought about in the United States. Here, too, only a few states border directly on the ocean. These states could agree among themselves which of them would have a nautical college, so as to avoid duplication in too small a territory. These nautical colleges could come under the head of the state university or be attached to the public school system, but they should, like our approved flying schools, be under the jurisdiction of the Department of Commerce in Washington, so as to guarantee a uniform and high standard throughout the country. The instructors in these schools should consist of 30 per cent college-trained men, who should teach subjects like maritime law, physics, English, first aid, ship construction, marine engineering, electrical engineering, radio engineering, and 70 per cent men holding a master mariner's license unlimited and who should teach nautical astronomy, navigation, seamanship, Rules of the Road, stowage of cargo, signaling, compass adjusting, and if possible go on short cruises with the students, on which the students would learn to navigate and handle ships themselves. As we have very few trained teachers among the master mariners at present, it would be advisable to have the men holding a master mariner's license attend college for about six months, in which time they would take courses in mathematics and the psychology and methods of teaching. The head of each college should be a person holding a master mariner's license. The duration of the course should be at least eight months for the mate's license and six months for the master mariner's license, both unlimited. The attendance should be compulsory and the record of attendance be supplied the examining board before the examination.

At present the examinations for licenses are held by the local steamboat inspectors. This condition should be changed, for these men have too much work on their hands, inspecting ships and in other various duties, to really allow them to give proper attention to these examinations. Besides, as every local inspector makes up his own examination problems, there is no uniform standard in this respect and a man may pass before one inspector, while he would fail before another, all depending on the quality of the questions asked. For this reason I would suggest that the examinations be held at these colleges at certain specified times, instead of at the offices of the local inspectors. The examinations should be given under the supervision of a nautical expert, sent by the federal government in Washington, one master mariner and one instructor of a nautical college located in some other state. The examination questions should come from Washington, so as to guarantee a standard examination. The tuition at these colleges should be free or only nominal. To enable those men who already hold a license to review some of the subjects related to their profession or to become acquainted with the newer methods of navigation, postgraduate courses of about four weeks duration should be given, also short courses in compass theory and adjusting, which could be voluntary. Special emphasis should be placed on English, so that the future officer has at least the same knowledge of English as a high-school graduate possesses.

O'Kay

By CAPTAIN E. C. KALBFUS, *U. S. Navy*

STEAM has supplanted sail. The only oars on board are those for the race boats and lifeboats; there are motors in many of the lifeboats. The magnetic compass with its red-headed needles, its dygograms and coefficients, is in the "stand-by" condition, while Brother Gyro clicks day and night in faithful adherence to the true pole. The fierce whiskers which struck terror to the hearts of the midshipmen, and possibly concealed a weak chin are gone. The smoking lamp is rarely ever "out." It is true that the flat hat remains.

These matters are purely maritime and naval. On the so-called outside, the pasture claims old Dobbin, while better automobiles are built and not better driven. Fancy and expensive cigar lighters are much in evidence although there are still those who cling to the reliable match. Short skirts have come and who is there to say whether they shall again permanently lengthen? The country is *dry*. And, shades of Old Black Joe, we learn that the picturesque darkey of the cotton fields is to be pushed out by an efficient mechanical picker. But why enumerate? We all sense the transformation, call it advance, progress, evolution, signs of the times, change, modernism, or which you will. The fact remains that things are not what they used to be.

Riding proudly in on this same flood tide is a plausible little fellow named O'Kay. His name suggests Celtic extraction, but he is American born. He first appeared affixed to an official document (not naval) at the hand of a somewhat, to say the least, illiterate gentleman who thought he was abbreviating "Oll Korrect." From this obscure origin, O'Kay's progeny has multiplied and is everywhere. A western branch of the same family goes by the name of Youbet.

O'Kay, as we meet him here and there, is not really a bad chap. He is incisive and clean-cut; he embodies willingness, assurance, and coöperation, even obedience. Being native born, he has a great hold upon the American people. In time he will doubtless creep into the dictionary just as have boycott, gerrymander, and others who possess the gift of clear expression.

Youbet is sometimes a visitor aboard ship and it is refreshing to welcome him as such. We agree with a recent contributor to these pages that our profession, and the customs of the sea, tend to make one a bit hidebound and uncompromising. But we are not really snobs and we deeply sympathize with the newspaperman who, on board for passage, glanced involuntarily at a near-by door when told he would have to sleep on a transom.

O'Kay, however, is actually in the Navy and we cannot say with certainty that he came in through the hawse pipe. He jumps merrily back and forth along the fire-control telephone lines. He floats up from the boats and issues from the bakeshop and galley. He is not unknown on the bridge. And he constantly interferes with a gentlemen of ancient lineage whose name is Aye Aye.

This latter individual went to sea long before the United States Navy was born and his honorable position is unquestioned. He possesses all the fine attributes of O'Kay and has, in addition, dignity and tradition. He is not, however, native born. This may be against him in the eyes of those who can see no good in any foreign country but who, nevertheless, smoke Havana cigars and demand imported Camembert.

We question O'Kay's right to continuous service in the Navy. We see no vacancy for him and we opine that, if he must remain, he had best be seen and not heard. In any event, as a classmate of ours pithily remarked recently, we should at least be consistent and, if we keep him, tog him out in Evening Dress Blue Baker and call him Option King.

The Solar Eclipse Expedition 1929

By COMMANDER C. H. J. KEPPLER, *U. S. Navy*

AN ECLIPSE of the sun, remarkable for the duration of its totality, took place on May 9, 1929. The belt of totality, about ninety miles wide, stretched over a long path beginning in the Indian Ocean, thence across the southern China Sea, northern Sulu Sea, and into the Pacific Ocean. The maximum length of totality for this eclipse at any place was 5 min. 7.3 sec., but unfortunately the places of maximum duration all lay at sea.

The important land areas over which this dark shadow passed began with northern Sumatra, then Siam, and eastward across the central Philippines. The length of the total phase along the center of totality in the Philippines varied from about 3 min. 55 sec. at Dumaran Island, Palawan, to 3 min. 28 sec. at Siargao Island. The important town of Iloilo, on the island of Panay, was almost exactly on the central line, and at this place the duration of totality was about 3 min. 43 sec. The times of mid-eclipse and percentages of sun eclipsed for the Philippine area are shown on Fig. 1.

The great interest shown by astronomers and scientific institutions in a solar eclipse of this long duration is evidenced by the fact that no less than ten expeditions, representing American, Australian, British, German, and Japanese observatories, were sent out to observe this unusual phenomenon. These expeditions were prepared to make photographic and spectroscopic studies of the sun's corona during the time the moon completely obscured the surface of the sun. Unfortunately, however, owing to clouds or other unfavorable weather conditions, or due to the improper functioning of some of the equipment, only the U. S. Naval Observatory Eclipse Expedition succeeded in securing a completely satisfactory set of observations and photographs.

In the U. S. Naval Eclipse Expedition, organized and sent out by our own Naval Observatory at Washington, the principal scientific members were Professor and Mrs. W. A. Cogshall of the University of Indiana, Astronomer Paul Sollenberger of the Naval Observatory, and Lieutenant H. C. Kellers (M.C.), U. S. Navy. The director of the Manila Observatory, Rev. Miguel Selga, also assisted the expedition in every possible way. A special working party of about ten enlisted men, artificers and mechanics, from the Asiatic Fleet was provided by the commander in chief, as well as a vessel of the mine sweeper class to act as a tender and to assist the expedition. The eclipse party with its ten or more tons of equipment on board the U.S.S. *Penguin* arrived at Iloilo on March 9, 1929, and at once began a careful survey of possible sites for the erection of the apparatus with which to make the photographs and other observations. Finally a suitable location was selected on the grounds of the terminus of the Philippine Railway at Lapus just across the river from the city of Iloilo. The geographical position of this site was determined as latitude 10°-41′-50″ N. and longitude 122°-34′-50″ E.

The apparatus set up and used for the eclipse observations consisted of one camera with a 65-foot focal length; two 11-foot cameras for use with the celostat; one 14-foot reflector camera, a special, very ingenious, and efficient instrument designed by Professor Cogshall; and two cameras mounted on a polar axis, one of 46-inch and the other of 38-inch focal lengths. All these cameras had their individual clock mechanisms for counteracting the motion of the earth during exposure times, and reflecting mirrors as necessary. In addition there were a radio receiving set for obtaining time signals, a chronograph, the usual instruments for meteorological observations, and a photographic laboratory for developing plates and films. Also on the day of the eclipse a motion-picture camera party

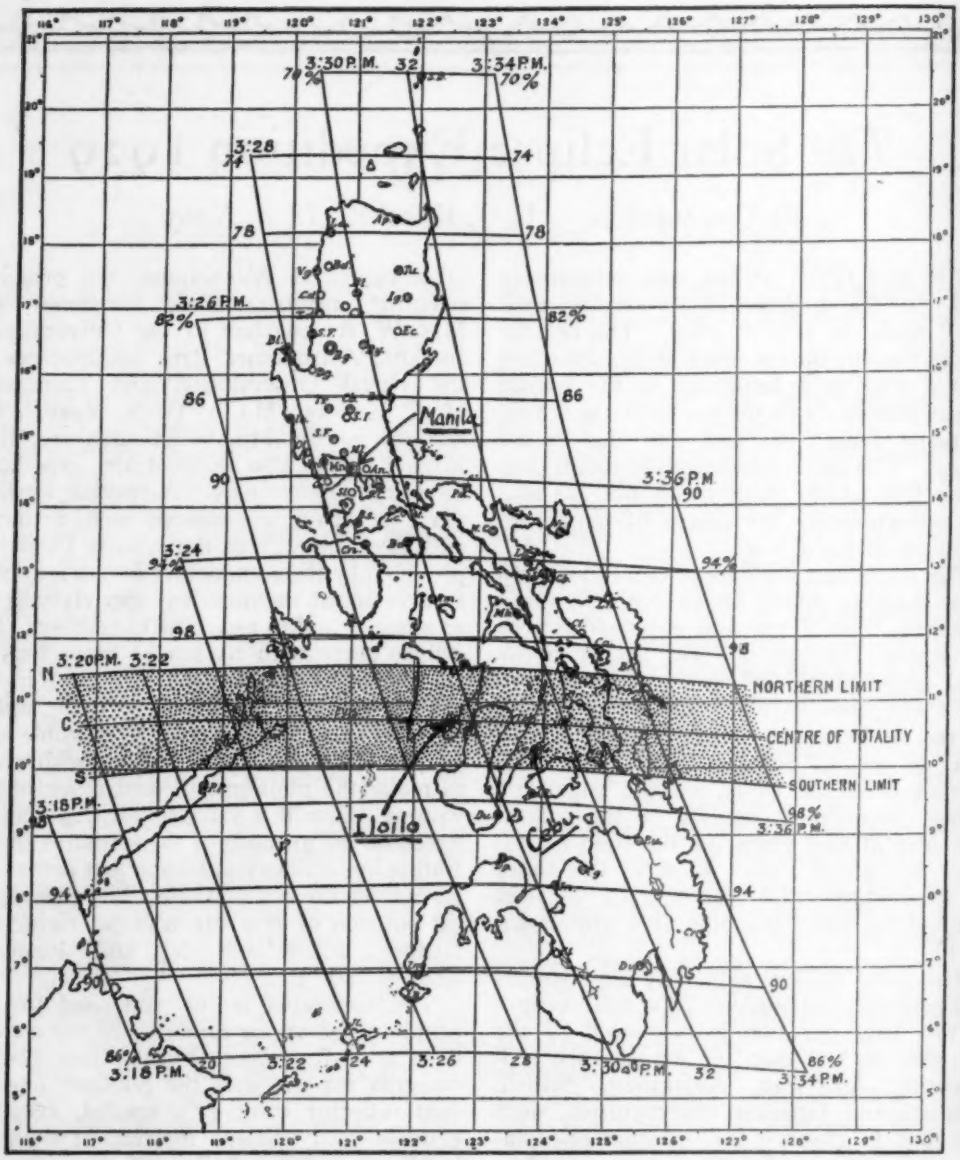


FIG. 1.—Center of eclipse

took movies of the sun, between the times of first and last contacts, from a location near Antique, about fifty miles west of Iloilo; two planes from the Aircraft Squadron, Asiatic Fleet, took photographs and made sketches from altitudes of about five and ten thousand feet; and the U.S.S. *Hulbert* conducted special radio tests at Iloilo.

The greatest task confronting the expedition was the erection of the 65-foot camera with its double tower, long tube, supporting structure, and plate room, which last had to be large enough to accommodate two men to shift the 16″ by 20″ plates and to contain the clock mechanism which controlled the movement of the plate carriage. The function of the inner tower was simply to support the large camera lens without permitting any vibration or movement of

this lens, if possible. This inner tower rested on a concrete foundation and was completely insulated from the outer tower and tube, the outer tower being covered with bamboo matting, "swalli," as a windbreak. The tube and plate room, of course, had to be *light-tight* and the joint between the lens tower and the tube was accomplished by a "flexible connection" of several layers of black velvet. As this whole structure when once erected could not be moved, it had to be built in such a position as to be exactly pointing at the sun during those few minutes of totality. At mid-eclipse time the sun's altitude and azimuth, as previously calculated, would be 35°-33′, and North 76°-21′ West, respectively. The erection of this camera, with the facilities available, may be regarded as a neat piece of construction and required continuous checking and rechecking on the part of all hands of the eclipse party.

The *objectives* as outlined by the Naval Observatory for the eclipse expedition were briefly as follows:

1. A series of photographs of the inner corona with the 65-foot lens on a schedule arranged in coöperation with Professor Miller of Swarthmore, who was to make a similar series in the neighborhood of Sumatra. (The eclipse took place there about an hour and a quarter before it did in the Philippines.)

2. A series of photographs of the middle corona on a small scale with the 46-inch lens.

3. A series of photographs of the outer corona on a small scale with the 38-inch lens.

4. A series of moving pictures beginning at first contact taken at intervals of about one exposure every five seconds during the partial phase, using a small stop and light filter to prevent overexposure. A continuous series, at about 3-1/2 exposures a second, beginning about one minute before totality and extending to one minute after the end of totality, using full aperture during totality. A series at intervals, the same as between first and second contacts, during the last partial phase extending to the end of the eclipse.

5. Observations of the times of all contacts, first, second, third, and fourth with 3-inch telescope. Observations of the times of first and fourth contacts with the finder on the polar axis. (Twelve photographs, for each "contact," at exactly one minute apart by chronometer, were actually taken with one of the 11-foot cameras.)

6. Observations of shadow bands.

7. Drawings of corona by naked-eye observers and local artists.

8. If accurate maps are not available, the latitude and longitude should be obtained by sextant observations. Observations for time should be made frequently, and available time signals should be observed.

9. A meteorological record should be kept during the period the station is occupied, with special attention to the degree of cloudiness at the eclipse hour each day, i.e., between 3:00 and 4:00 P.M., local time.

10. The possibility of impressing standard intensity squares on the photographic plates should be considered.

11. If there are plenty of observers available, some should be detailed to note the positions of bright stars or planets during totality and to make notes on the general illumination during the eclipse, compared with the light of the full moon.

12. Such additional photographic observations or other observations as available equipment and personnel may permit. (These included observations, sketches, and photographs made in the air by the two Navy planes.)

Very fortunately the expedition was favored by almost perfect weather conditions during the eclipse, and it is considered that the objectives outlined above were successfully accomplished. After all apparatus was in position, for a week before eclipse day in the gathering darkness just after sunset, all hands in the eclipse party, plus the necessary members from the crew of the U.S.S. *Finch*, went to "general quarters" and drilled at their "stations" until every duty required by the scheduled program could be faultlessly performed. As a result, fifty-six negatives, with exposures varying from ½ second to 65 seconds, were obtained from the six cameras in operation on the grounds at Lapus, besides the twenty-four negatives taken with one of the 11-foot cameras for "contact times." Several sketches were made by observers on the ground at the eclipse site, and in addition an artist's impression from one of the two Navy planes that made observations and took pictures from the air. A compari-

son of the pictures of the corona as taken with an ordinary photographer's 6½" by 8½" view camera, operated by an Army sergeant from Camp Nichols, and the 11- and 14-foot cameras, gives a good idea of the relative sizes of the images as received on the plates. The image of the sun obtained with the 65-foot camera was about 6½ inches in diameter and on some of the long exposures the coronal streamers reached almost to the edges of the 16" by 20" plates, while on the short-exposure plates the mysterious prominences close to the surface of the sun are clearly defined. Note especially the "flag" and the "loop," extending for nearly 100,000 miles from the top and bottom edges of the sun, respectively. The negatives from all cameras were developed under very unfavorable conditions of hot, humid, and rainy weather during the five nights following the day of the eclipse, but by the use of many hundred pounds of ice, for cooling purposes, and a specially constructed drying rack, shielded with cheesecloth to keep off dirt, bugs, and insects, the negatives were eventually dried and packed for shipment to the Observatory.

During the period of preparation, Dr. Kellers had rigged a most complete biological laboratory in the railway station house at Lapus, and soon the natives of all the neighboring islands, including even Mindanao, were bringing in rare and valuable specimens of Philippine flora and fauna. Before our departure from Iloilo, Dr. Kellers' collection had filled some sixty-four 5-gallon cans—"the ubiquitous Standard Oil type"—for the National Museum; and innumerable specimens of live animals, birds, insects, and reptiles for the National Zoo were safely housed in cages for transportation to Washington on the *Henderson*.

The Manila Observatory had a party of observers on the grounds at St. Augustin College in Iloilo, under the direction of Rev. Miguel Selga. This party was principally engaged in obtaining meteorological data for several days before and during the eclipse, and also collected reports from many observers scattered throughout the Philippine Islands within the path of the eclipse. In fact "the padres" over this whole region were diligently engaged for weeks beforehand in assuring the natives that no catastrophe to themselves was involved in this spectacular performance of the sun. Nevertheless one enterprising "politico" in northern Panay, coming up for reëlection about that time, promised his "barrios" that if they elected him *he would see to it* that on a certain date in May the sun would disappear for many minutes and then come back again to approve his election.

Also on the Normal School grounds at La Paz, Iloilo, an independent party composed of two British scientists, Drs. R. L. Waterfield and W. E. B. Lloyd, established an eclipse site and obtained many photographs with their spectographic cameras.

These two eclipse parties and our own worked together in closest harmony and cooperation. In fact the results obtained with our motion-picture camera would not have been possible without the loan of certain light filters provided by Dr. Waterfield for use in connection with the special lens which had to be adapted to the movie camera. Furthermore, Rev. Selga was untiring in his efforts to assist the expedition. He placed all the facilities of the Manila Observatory at our disposal and perfected many details of the arrangements necessary with the local authorities and representative citizens at Iloilo. The above assistance was all the more appreciated and essential as the Naval Eclipse Expedition carried on without any special appropriation of funds, and the many incidental and unforeseen expenses had to be met from the subsistence and travel allowances of the individual members of the party.

However, as recently expressed in the Washington *Star* by Dr. John A. Miller of Swarthmore College:

> Our universe offers no more fascinating spectacle than a total eclipse of the sun. At the instant that the last vestige of the sun's disc disappears behind the moon, the corona, a pearl gray crown of light entirely surrounding the sun and extending some millions of miles above the sun's surface, blossoms like a huge tropical flower against the cerulean hue of the sky.

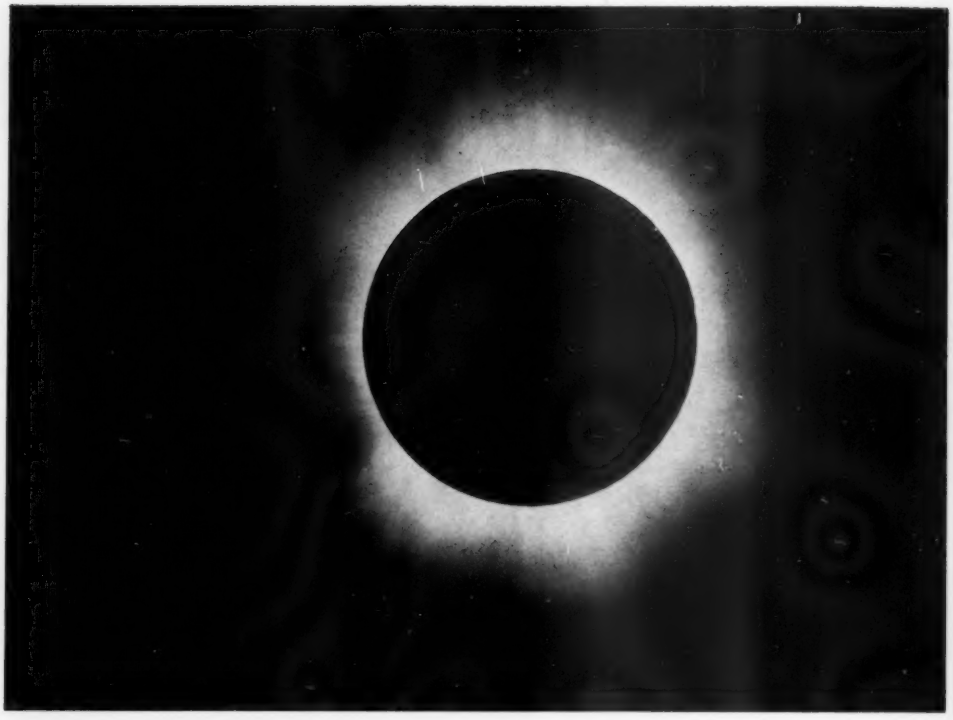
Our own artist, in the plane at 10,000 feet, pictured the sky as a "dark brilliant purple" and declared that it was "the most thrilling and awe-inspiring spectacle he ever expected to experience." We observers on the ground confirmed his declaration and hoped we might again enjoy the eerie sensations at the next long eclipse that takes place in the Philippines, namely, one of *over seven minutes* totality due on June 20, 1955.

TWENTY-FIVE SECONDS' EXPOSURE WITH ELEVEN-FOOT CAMERA

Courtesy Commander C. H. J. Keppler, U. S. Navy

TWO SECONDS' EXPOSURE WITH ELEVEN-FOOT CAMERA

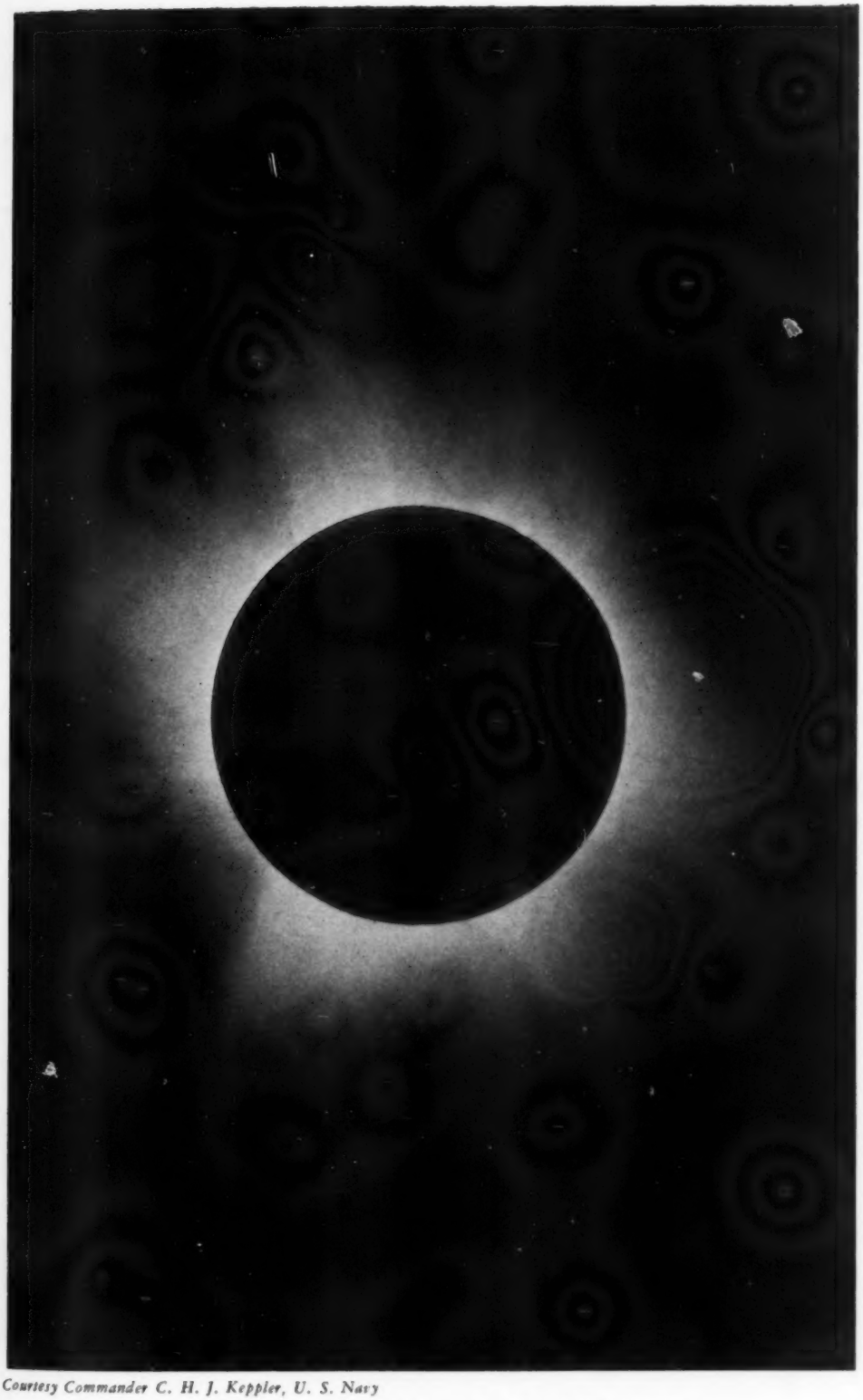
UNIV OF MICH



FIFTEEN SECONDS' EXPOSURE WITH FOURTEEN-FOOT CAMERA

Courtesy Commander C. H. J. Keppler, U. S. Navy

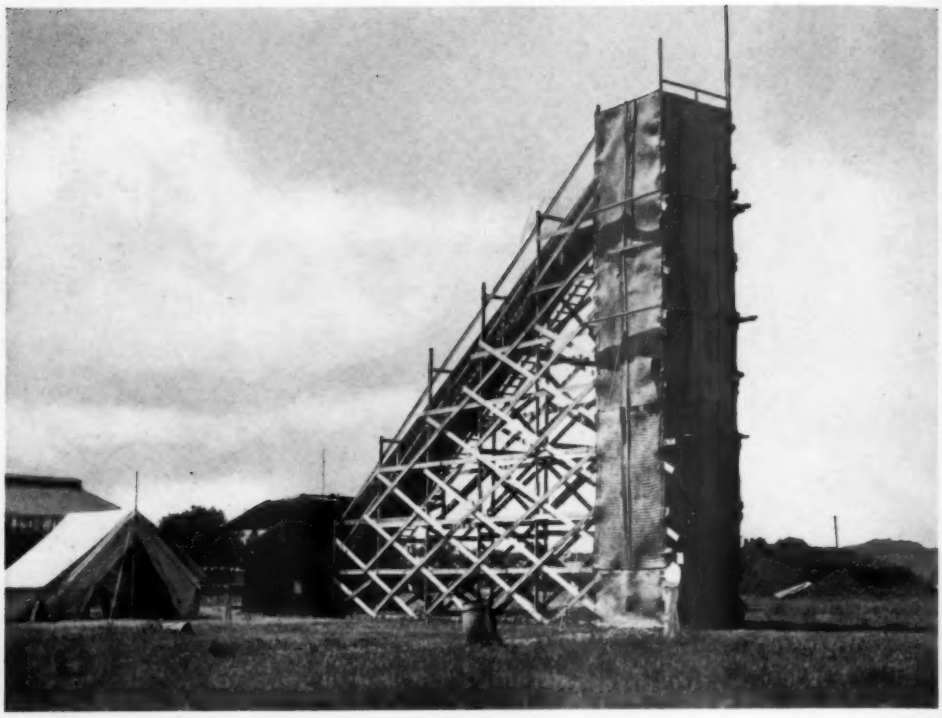
ONE-HALF SECOND EXPOSURE WITH FOURTEEN-FOOT CAMERA, JUST BEFORE END OF TOTALITY



Courtesy Commander C. H. J. Keppler, U. S. Navy

THIRTEEN SECONDS' EXPOSURE WITH ELEVEN-FOOT CAMERA
(Enlarged three times)

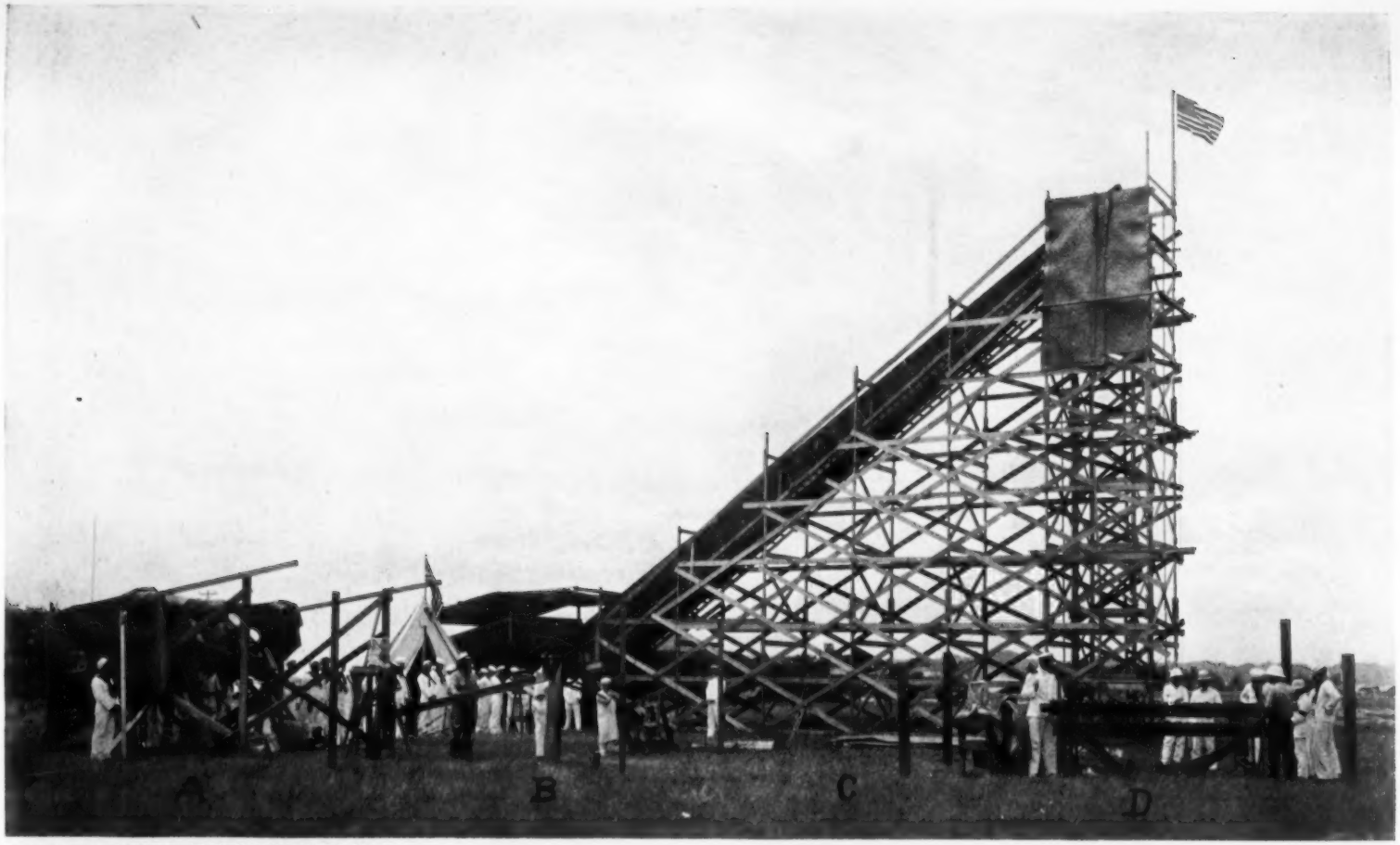
UNIV. OF MICH.



SIXTY-FIVE-FOOT CAMERA COMPLETED. NOTE THE "WIND BREAK" FOR LENS TOWER

Courtesy Commander C. H. J. Keppler, U. S. Navy

CELOSTAT AND CLOCK MECHANISM FOR TWO ELEVEN-FOOT CAMERAS



Courtesy Commander C. H. J. Keppler, U. S. Navy

ECLIPSE PARTY AT "GENERAL QUARTERS STATIONS"

A. Polar axis with thirty-eight-inch and forty-six-inch cameras. B. Fourteen-foot reflector camera. C. Sixty-five-foot camera, shows inner tower for lens support. D. Celostat and two eleven-foot cameras.

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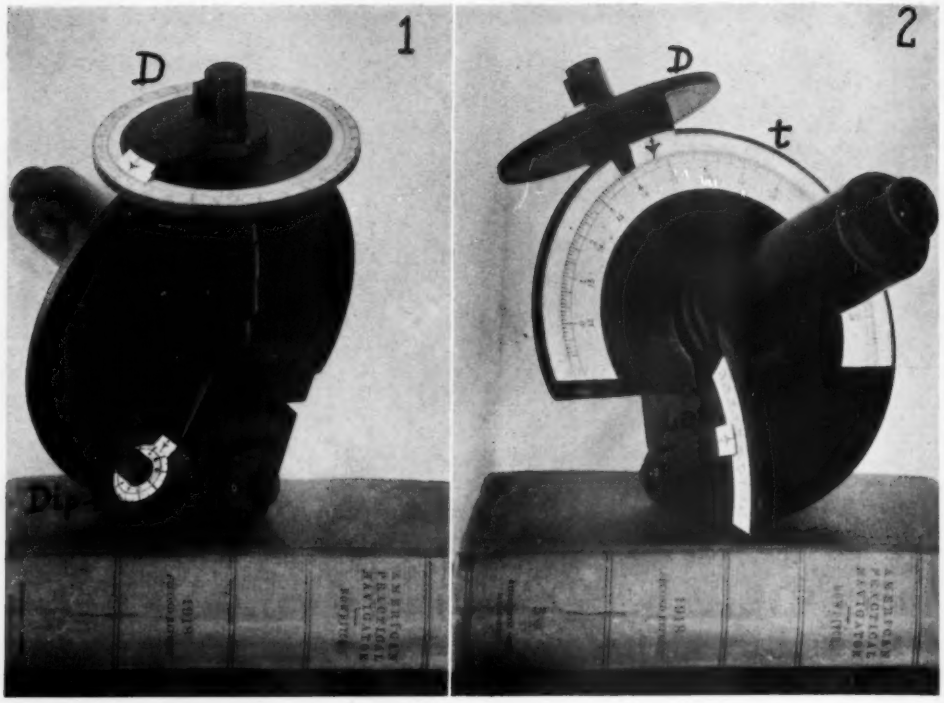
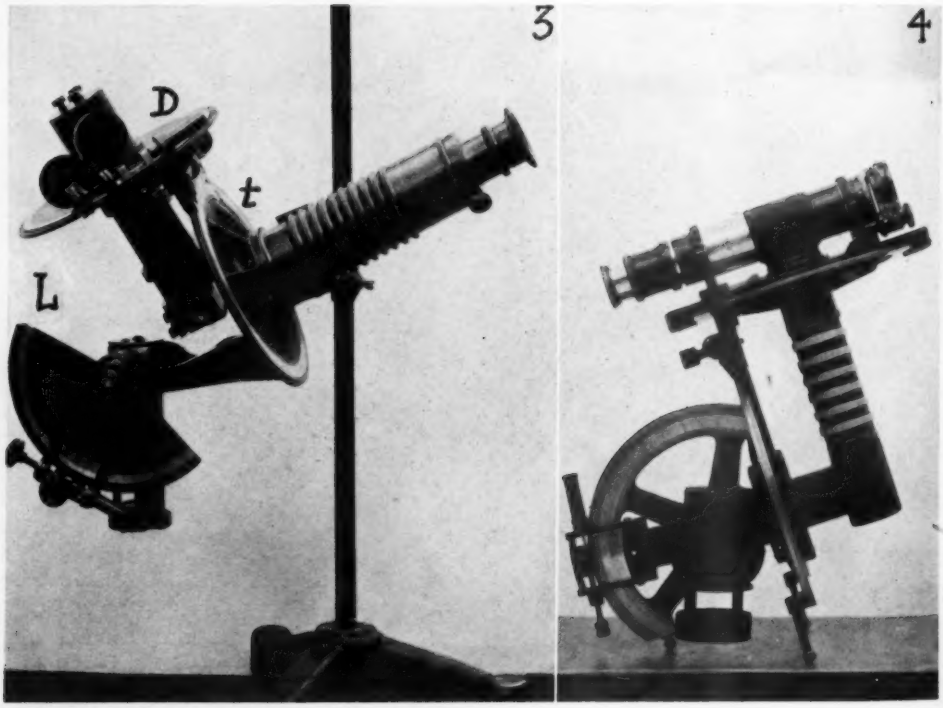


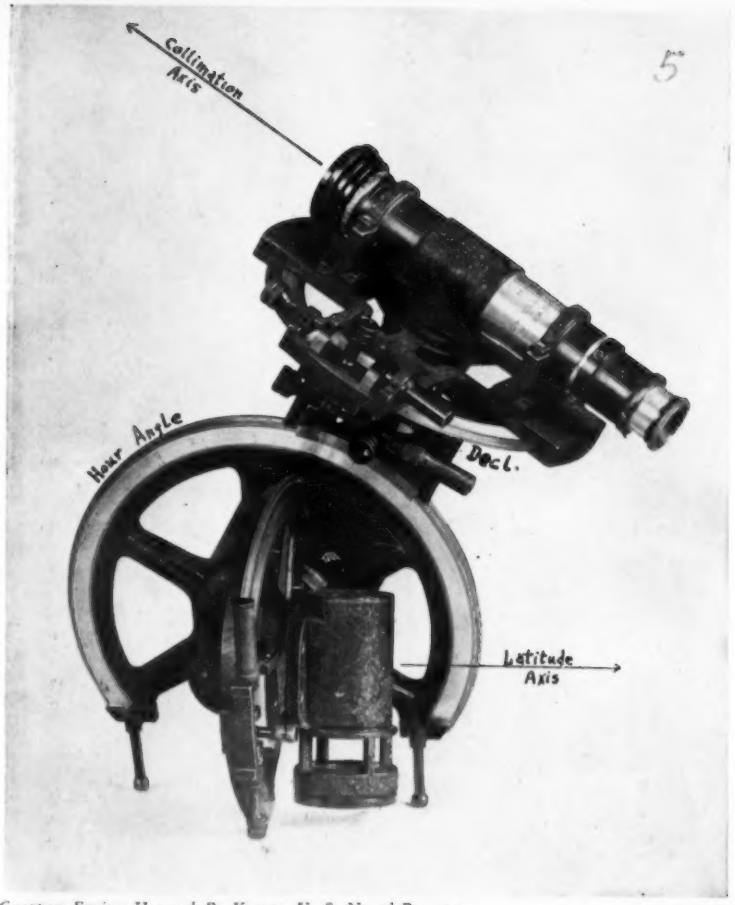
Two views of first model

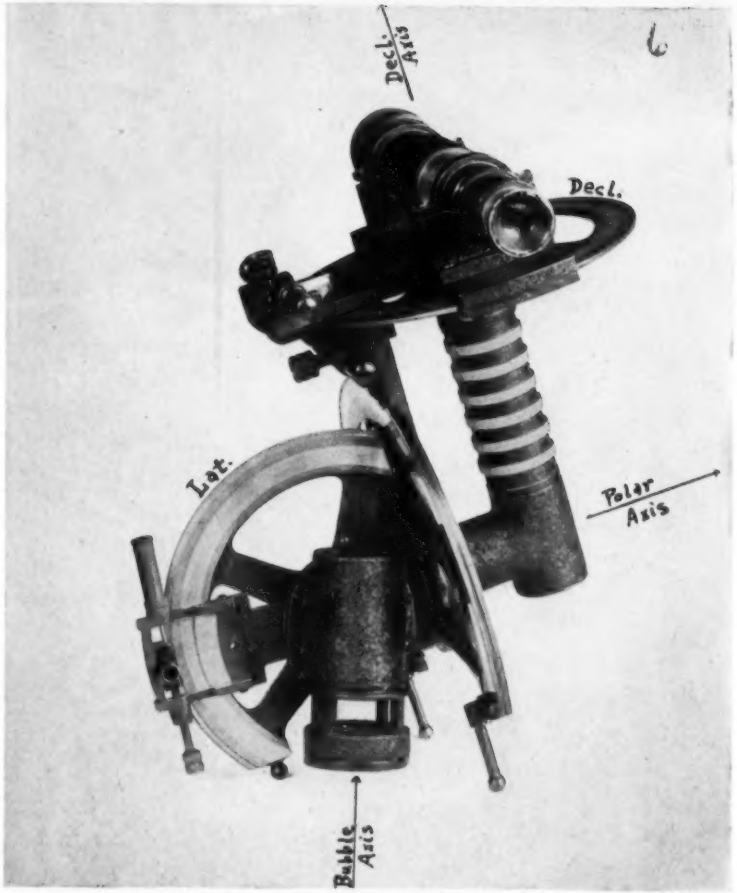


Courtesy Ensign Howard B. Kaster, U. S. Naval Reserve

DEVELOPMENT OF THE SPHERANT

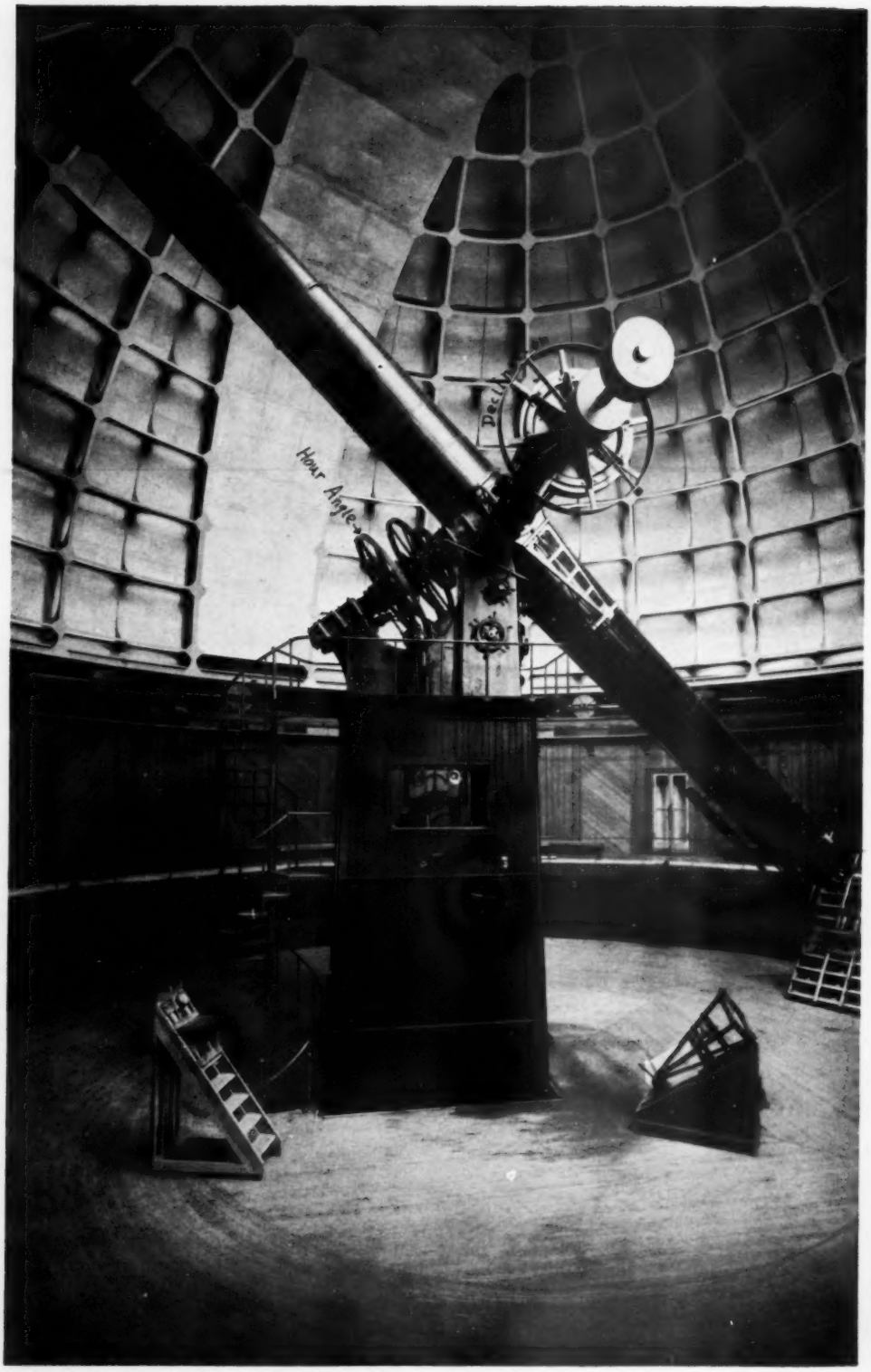
Second model Third (final) form





Courtesy Ensign Howard B. Kaster, U. S. Naval Reserve

TWO ADDITIONAL VIEWS OF THE SPHERANT



Courtesy Ensign Howard B. Kaster, U. S. Naval Reserve

EQUATORIAL TELESCOPE AT THE LICK OBSERVATORY

The Spherant

An Instrument for Observing Hour Angle or Latitude Directly

By ENSIGN HOWARD B. KASTER, *U. S. Naval Reserve*

THE instrument described in this article has been under development at the University of California for several years. It breaks the two-hundred year old tradition that a navigator, in order to find his position, must measure an altitude and then solve a spherical triangle. The instrument gives directly either hour angle or latitude. The observed hour angle, combined with the proper Greenwich hour angle from a watch or chronometer, yields the longitude. Usually such latitudes and longitudes are not independent but lie along a Sumner line as in the case of reduced sextant observations. The advantage lies in the elimination of practically all computation or use of tables. The instrument has the same weight as the average sextant, and *with the same amount of practice,* is as easy to observe with. It is called a Spherant.

Coming so soon after a remarkable series of developments in nautical tables it may be well to review the differences between the two lines of attack. The considerable number of new tables which have appeared in recent years are designed to give a navigator the solution of an astronomical triangle and thence a line of position with the minimum amount of computation. The entries into the various parts of the tables require little or no interpolation, and these entries can be made, the necessary additions and subtractions completed, and the altitude difference determined, in less than five minutes when one is familiar with their use. These solutions are, therefore, made in about one-fourth of the time required by the old logarithmic methods such as the φ'' φ' sight or the time sight. This saving of time and work is perhaps of no greater importance than the accompanying reduction in the chances of making a numerical error in computation. In some cases the formulas employed have been known for a long time, or the advantages of the particular arrangement or combination may have been predicted. Regardless of such facts, navigators owe their greatest debt to the men who have had the genius, patience, and courage necessary to arrange tables in practical form, have them printed, and made available. When the history of the subject is written it will show that in recent years there has been a rapid succession of such developments bearing the names of Aquino, Littlehales, Ogura, Weems, and Dreisonstok, together with other developments of less immediate practical importance.

In general, these modern methods are based on the supposition that a navigator with a sextant, *Nautical Almanac,* and Greenwich time chronometer has available the altitude, declination, and Greenwich hour angle. He desires his latitude and longitude, but usually the nearest approach to his desire is a line of position. In the old time-sight method an altitude, declination, and latitude are employed in solving a spherical triangle for the hour angle, which when applied to the Greenwich hour angle gives the longitude. The more modern method involves a reversal of this procedure and employs a declination, an *assumed* hour angle, and an *assumed* latitude in solving a spherical triangle for the altitude. Most of the developments in nautical astronomy have been in the direction of simplifying the solution of this astronomical triangle. Numerous mechanical devices, such as combinations of graduated circles, cylindrical slide rules, and graphical diagrams have been employed but for various reasons have proved to be less satisfactory

than tables. The one marked exception is the Weems series of star altitude curves for reducing two simultaneous star altitudes.

For two hundred years, then, mariners have been measuring altitudes with sextants. Before this altitude can be of any value an astronomical triangle must be solved. That the methods of solving this triangle have reached a high degree of perfection is indicated above and is well known to all progressive navigators. But is it necessary to measure an altitude at all? Why not measure something more closely related to the desired quantities?

A somewhat neglected line of development in navigation is that of orienting, by means of either gravity or the horizon, and a line of sight to an astronomical body, an instrument so designed that a desired quantity is read directly from a graduated arc, even when this result is an angle between imaginary points in the sky. For example, a surveyor's "solar attachment" places the vertical circle of his transit in the plane of the meridian; the sun compass in the same way indicates the true meridian; and the equatorial mounting of the telescope in an astronomical observatory gives the hour angle and declination of an object. It would hardly be proper to classify such instruments as mechanical methods of solving the astronomical triangle; perhaps "automatic solutions" would be a more nearly correct term, but in all three cases the desired result is obtained directly from the instrument, and, although the result is dependent upon the apparent altitude or zenith distance of the celestial body, these instruments have no arcs corresponding to this side of the astronomical triangle.

To an astronomer the instrument presented here is easily explained by analogy with his equatorially mounted telescope: Suppose that such a mounting is correctly adjusted in azimuth and provided with a graduated arc for measuring the elevation of its polar axis. If a known declination is then set off on the declination circle and the object sighted along the collimation axis, the telescope will give the local hour angle of the body and the observer's latitude. If the telescope and its mounting is then made portable and the pier provided with some kind of a leveling device it can no longer give both latitude and hour angle but will give either one if the other is provided. In doing so the polar axis will automatically be placed in the plane of the meridian. If various values of either latitude or longitude, and hence hour angle, were assumed, such an instrument could give a corresponding value of the other coördinate such that the assumed and instrumental coördinates taken together would be the coördinates of a point on the Sumner line of position. There is a vast difference between such an uprooted observatory telescope and a practical navigational instrument, but it was along this line of reasoning that development was started. Probably, to navigators not familiar with observatory instruments, the principle is less clear from this explanation than it is from the explanation of the use of the developed instrument which follows later. Many astronomers and navigators have undoubtedly thought of such an application but probably in thinking ahead, several apparently insurmountable difficulties became apparent. The present development was almost given up as hopeless on several occasions, and three different instruments, each of a fundamentally different design, were constructed before anything of a really practical form resulted. Photographs of the three models are shown here and a detailed account of their various characteristics may be published soon in a University of California publication. The present article is limited to a description of the construction, principle, and use of the final form only.

LEVELING DEVICES

This instrument, like a sextant, must make use of either the horizon or a leveling means of the "artificial horizon" sort. It was originally planned to construct two kinds of instruments, one for use on shipboard, making use of the horizon, and another equipped with a bubble cell for use in aircraft. There are, however, so many occasions when each method would be of value in the field commonly covered by the other that a system has been worked out whereby in the same instrument either a bubble or the horizon can be employed at will, or both seen at the same time. There is so much confusion among many navigators concerning the value of a bubble and so much thoughtless prejudice against "bubbles" even by some naval aviators that the advantages of this combination may in some

cases be misunderstood unless further explanation is given.

It is true that the irregular horizontal accelerations of a plane may make even the mean of half a dozen bubble-sextant readings uncertain by five to twenty miles, and this makes a poor comparison with the work of the surface navigator who sometimes carries fractions of a mile through his computations. Yet this is all that is ordinarily possible as the horizon is available to a plane only during a small part of the time that celestial bodies are visible. The horizon is lost in haze at a relatively low elevation. Sometimes a horizontal line or two may be seen from a high altitude but these are usually the surfaces of air strata of different characteristics and have unknown dips with respect to the position of the true horizon. To use the horizon then requires coming down close to the surface, a proceeding opposed to one of the first principles of aërial warfare, as well as being an inconvenience. Furthermore, as surface navigators also are aware, the horizon is invisible on many days when the sky is fairly clear but atmospheric visibility low, and it is seldom visible at night. A plane covers ground so rapidly that lack of night (or day) observations would be far more serious than in the case of a ship. A substitute for the horizon is therefore of sufficient importance to justify even considerable loss in accuracy. Considering speed and visibility, ten miles are not of much more importance to the average plane than a mile is to the average ship. The absence of long flights requiring celestial navigation in peace time sometimes obscures the fact that there are some types of military aircraft which in war time must be able to navigate by celestial observations. A great deal of experimenting has been done with pendulums, gyroscopes, spirit levels, etc., and even more remains to be done, but so far the spirit level or "bubble" is the simplest and most satisfactory means. An artificial horizon of this sort makes observations possible at high altitudes, on days when the horizon is indistinct even at the surface, at night when complete fixes are possible, and even from above a cloud layer. It therefore makes celestial observations available during a very much greater portion of the time than would be possible with the horizon. The issue of bubble-type instruments to aircraft units is the result of serious study of the problem from the point of view of long-distance military flying.

It quite frequently happens that a bubble can be of considerable value on surface ships. For general all-around navigation a bubble instrument would be of very little value on any type of surface craft. The rolling of a ship ordinarily produces accelerational errors of greater magnitude than those experienced in a plane—especially if the observer ignores the motion of the ship. With a little study of the problem quite different results become possible. A ship has so much inertia in comparison to the forces involved that horizontal accelerations produced by irregular translation of the ship as a whole produce the smallest part of the effect. The greater part of the accelerations comes from rolling and pitching. (The reverse is true in aircraft where, furthermore, the observer is never more than a few feet from the center of rotation.) This quasi-periodic motion produces the maximum horizontal acceleration at the instant when the ship is farthest from its normal, quiet-water position. It becomes practically zero when the horizontal motion of the observer is the greatest, i.e., when the ship is passing through her level position. By making the coincidence at this point of the ship's motion surprising results can be obtained. The first time the writer attempted to apply this reasoning was on board the U.S.S. *Chaumont* on the afternoon of September 24, 1929, off the coast of California, approximately fifty miles south of San Francisco. Between 3:25 and 3:35 P.M. seven longitudes were observed with a spherant equipped only with a bubble. The average error of a single sight was eight seconds (time) of longitude, or 1.6 miles. The maximum error in the series was fourteen seconds of longitude or 2.8 miles. At the end of each roll the bubble was tight against the side of its cell and by observing at the wrong time it could have been truly reported that bubble observations gave errors of about 2°. This was done on a clear California day with an average fair-weather sea and well-marked horizon line so the horizon could have been used if sights were necessary. Consider, however, the advantage of such bubble sights to a mariner off Oregon and Washington during the forest fire season, for example, when the hori-

zon is obscured for days at a time. In addition to this, sights can be made when the horizon is invisible at night if utmost accuracy is not necessary, or possible.

CONSTRUCTION

The instrument contains three arcs or circles. The collimation axis of the telescope is perpendicular to, and rotates about, the axis of the declination circle. This axis is perpendicular to and rotates about the axis of the hour angle arc or "polar axis." The axis of the latitude arc is perpendicular to the polar axis and the latitude arc itself is vertical when the bubble is centered. The bubble cell is similar to that of a bubble sextant. (Hereafter the vertical line passing through the bubble when it is centered will be called the axis of the leveling device.) When the horizon is used two prisms under the bubble cell pass the rays from the horizon along this same axis, dip being allowed for by setting the height of eye on an indicator which tilts the prisms. Two portions of the horizon are used. They intersect at an angle in the field and this intersection is treated by the observer in exactly the same way as the bubble. An image of the bubble (or horizons) is superimposed upon the astronomical field by a series of reflectors (prisms) which pass the light from the bubble cell along the latitude axis, along the polar axis, then along the declination axis (the covering of which acts as a handle), and finally down the telescope tube towards the eyepiece. The latitude arc and declination circle are graduated to one minute of arc and the hour-angle arc to four seconds of time. All three have clamps, verniers, tangent screws, etc. The declination circle reads zero in the two positions where the telescope is parallel to the hour-angle arc, and is graduated up to 90° in each direction from these points. The hour-angle arc is graduated over twelve hours (180°) and marked by two series of numbers, one reading six hours and the other eighteen hours when the declination circle is perpendicular to the latitude arc. The latitude arc reads zero when the hour-angle arc and axis of the leveling device are parallel. It is graduated up to 90°.

Use of aluminum alloys for many parts of the instrument makes possible a small total weight. The instrument illustrated weighs only two pounds and fifteen ounces which is less than the average sextant. Suitable shade glasses are placed before the telescope and in a more compact design now under construction there is room in an extension of the handle for a small dry-cell battery for illumination of the bubble at night. Adjustments are made in the factory so that all index corrections are zero and they should remain so. An accident sufficiently violent to derange the optical system would damage the instrument beyond field repair anyway. A complete set of directions for making and checking each adjustment, step by step, can be provided for the benefit of the individual who cannot refrain from investigating the interior.

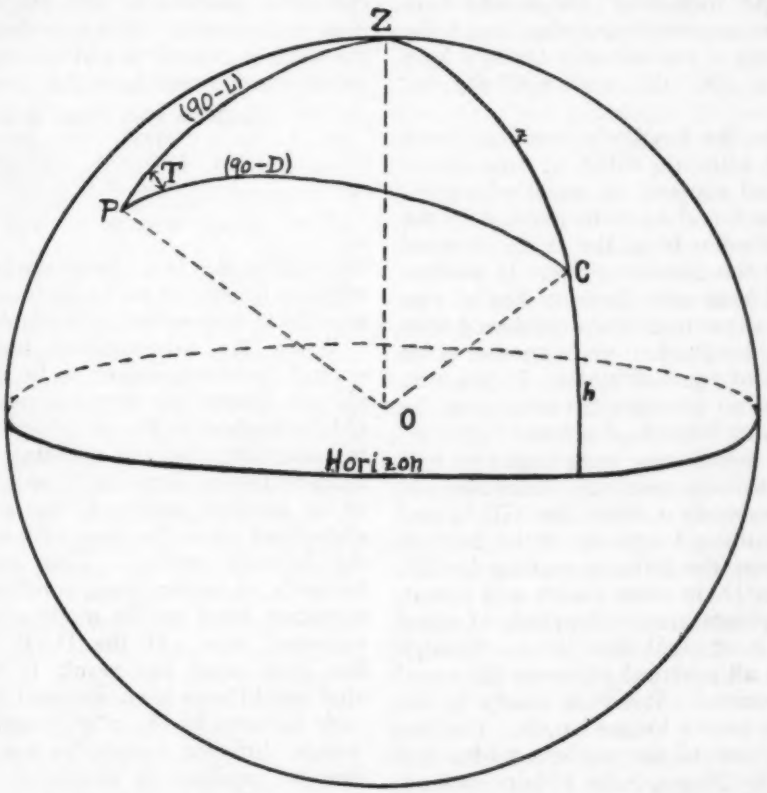
In the following description the word "bubble" is used for convenience but it can be replaced by the term "intersection of horizon images" to make it apply to the use of the horizon. It is hoped that all future instruments will contain both methods of leveling when made for use at sea.

METHOD OF OPERATION

Clamp the declination vernier at the known value of the declination of the object to be observed. Clamp the latitude and hour-angle arcs at arbitrary values and hold the axis of the leveling device vertical. This leaves the instrument free to rotate only in azimuth. Such a rotation causes the collimation axis of the telescope to sweep out an arc of a small circle parallel to the horizon. The altitude of this arc can, in general, be varied to make it pass through the object by changing the setting of either the latitude or the hour-angle arcs. The observer, looking into the telescope, in this way makes the images of the astronomical object and the bubble coincide within a ring which is marked on the bubble cell. This also makes the axis of the leveling device vertical. Some apprehension was felt because this coincidence, although not necessarily made on the intersection of the cross wires which marks the collimation axis, must yet be made somewhere on a certain line passing through this point. This at first glance seems to leave the observer with one less degree of freedom than when observing with most sextants. The error in this reasoning is seen when it is considered that with the direct-view telescope only two motions are required to move the object about the field, whereas in the case of the sextant, where the

body is brought down to the horizontal, there are three motions to be controlled, right and left, up and down, and rotation about the telescope axis. The comparison of the freedom of optical rotations in the two instruments is then closely related to the proverbial case of six of one and half a dozen of the other. Not quite so if we wish to quibble over the matter, for, in the case of the sextant, the effect of the mentioned rotation varies with the altitude, while in the case of the spherant the same amount of motion always produces the same displacement. The observer concentrates on the position of the astronomical body and gives the instrument a slight back and forth rotation about the collimation axis. This makes the bubble or intersection of the horizons move back and forth across the field. The direction of this motion is not of interest. It is merely necessary to have them pass over the astronomical object in the proper manner as they cross the field.

Consider now the relationship of the readings on the three arcs while the observer holds the instrument in this position. This study is assisted by reference to the drawing of the celestial sphere. On this drawing let Z, P, C, be the points where the axis of the leveling device, polar axis, and collimation axis respectively pierce the celestial sphere, and let L, t, D be the respective readings of the latitude arc, hour-angle arc, and declination circle. Remembering the construction of the instrument, it is seen that the elevation of the polar axis above the horizontal equals the reading of the latitude arc. The



arc PZ is then equal to $(90°\text{-}L)$. The latitude arc is vertical and parallel to the polar axis, so it must lie in the plane OPZ. Since the declination circle is parallel to both the collimation and polar axes its plane cuts the celestial sphere along the arc PC. Due to the method of marking the graduations, the arc PC always equals $(90°\text{-}D)$ if D is called negative when it is of opposite name to the latitude. The observer has made the angle between Z and C equal to the apparent zenith distance of the object when he placed C on the object. Let T be the angle between

the arcs *PZ* and *PC*. Since the latitude arc and the declination circle are both parallel to the polar axis, the hour-angle arc measures the angle between them, its reading *t* being zero when they are parallel. However, the angle between these circles is equal to the angle between their planes extended, so *t* is angle *t*.

If the *L* originally set off on the latitude arc was the dead-reckoning latitude, then *t* is the hour angle which would be obtained from computation by a navigator using the old time-sight formulas. He would have observed the apparent altitude, found the zenith distance *z*, and solved a triangle having sides *z*, (90°-*L*), and (90°-*D*) for angle *t*.

Let *Lo* be the longitude resulting from combining *t* with the GHA at time of observation, and suppose the point whose coordinates are *L* and *Lo* to be marked on the chart. This point is on the circle of equal altitudes, or the Sumner circle. If another latitude had been used the same line of reasoning will show that when combined with the resulting longitude it gives another point on the circle of equal altitudes. In practice, then, there is no necessity for employing the dead-reckoning latitude if a line of position is desired. Select some even degree or half degree of latitude near it. Make the observation, subtract *t* from the GHA, and plot the resulting longitude at the latitude used. Change the latitude reading by 20′, (30′ or even 1° in some cases) and repeat. These two points are on the circle of equal altitudes. A straight line drawn through them is for all practical purposes the usual "line of position." It differs chiefly by being accurate over a longer length. The line obtained by use of the modern tables is a tangent by the Marcq Saint Hilaire method, with the altitude difference laid off from a point on the full degree of latitude nearest to the dead-reckoning position. Such tangents are within a given distance from the circle of equal altitudes throughout a much shorter distance than is the secant line drawn through two points on the circle, but this is a theoretical rather than a practical difference. Those interested in the curvature of Sumner circles are reminded of the tables of such data given in *H. O. 203*, page xvi, and in Aquino's *Newest Sea and Air Navigation Tables*, page 115.

Two observations are not necessary as a single sight can be made and the azimuth determined by azimuth diagram, gyrocompass, etc. The second sight is, however, a matter requiring only a few seconds time. The instrument is ready except for a slight change in latitude and then a small movement in hour angle while observing. The line is on the chart immediately afterwards, especially if the latitudes assumed have been those of parallels on the chart, and if the longitude scale of the chart has had the time equivalents marked beside the arc units to eliminate conversion of longitude from time to arc units. If a complete record of the work is desired in addition to the record on the chart it may have this form:

March 30, 1930.		Dec. N 3° 47′
	37½°	38°
GHA	12ʰ36ᵐ04ˢ	12ʰ36ᵐ40ˢ
t	4 27 28	4 27 28
Long	8 08 36	8 09 12

Ordinarily the two observations are made within a minute of each other—within thirty seconds if a recorder is available.

When the astronomical body is near enough to the meridian to be changing its altitude slowly, yet not near enough for the old "reduction to the meridian" methods, it is convenient (but not necessary) to set the dead-reckoning hour angle or an hour angle at an assumed longitude for a short time ahead and make the observation by varying the latitude setting. This can be done leisurely as under these conditions the observation need not be made exactly at the expected time. If the D. R. hour angle has been used the result is the latitude that would have been obtained from an altitude reduced by the φ″φ′ formulas. If two widely different longitudes are assumed, a line of position is obtained. When the body is close enough to the meridian for treatment by the old "reduction to the meridian" methods it is convenient to set an approximate hour angle and observe the latitude several times before it is necessary to change the hour-angle reading.

A possibility worth mentioning is that of observing altitude or zenith distance. There are three cases where this may be desired: (1) When finding the distance of a light or other object by vertical angle. (2) When using the Weems's *Star Altitude Curves*. (3) When the navigator so enjoys the thrill of arithmetic that he prefers to make the

usual reductions. The last individual is advised to stick to the sextant as he might be tempted away from his hobby with a spherant at hand. In any event either zenith distance or altitude can be measured if desired. Set the hour-angle arc at zero. The latitude arc and declination circle are then parallel. If latitude is set at 90°, then altitude of any body under observation is found on the declination circle. If latitude arc is set at 0°, then on observing any body the declination circle gives zenith distance. Similar results can be obtained by clamping the declination circle and varying the latitude setting.

Corrections

Little or no mention has been made yet of the usual annoyances of dip, refraction, etc. Dip does not enter, of course, in the case of the bubble. With the horizon prisms it is introduced by tilting the prisms, the indicator being graduated according to height of eye. Refraction is more troublesome but fortunately is always given by one significant figure if one minute of arc is the accuracy aimed at. Ordinary refraction-in-altitude tables cannot be used. The tables used by surveyors which give refraction in declination for use with solar attachments are suitable if accompanied by a similar table for hour angle. The surveyor's table is, however, far more elaborate than is necessary for a navigator and would require using two corrections. A simpler method is to tabulate a correction to either hour angle or declination and have this correction to one coördinate contain the refraction in that coördinate combined with a quantity which exactly offsets the effect of the refraction in the other coördinate. An observer in the afternoon, for example, desiring a line of position, makes the observation as described before, and after recording the GHA finds in the refraction table a small quantity in seconds of time which he adds to the hour-angle reading on the instrument. The same refraction is applied to the second observation. The correction can be shown on a diagram two and one-half inches square or in a table of the size of a page in the *Nautical Almanac*. The moon requires two significant figures in the correction and an entire table for itself, parallax and refraction together being treated in the same manner as the refraction alone is for other bodies.

Ease of Observation

Probably the greatest question remaining in the mind of the reader is that of the difficulty of learning to observe with such a gadget. The optical system of the instrument can be made with the same power and field of view as any given sextant. It is then just as easy (or difficult) to observe with as the sextant if the same amount of practice is given to each. The advantages of the instrument are especially marked when teaching beginners in navigation. The beginner feels that he knows nothing in advance so listens quietly to instructions and obeys orders. He learns the names of the arcs and how to read the verniers in a few minutes. His first sight gives a longitude or latitude correct to the nearest mile or two. A few more practice sights and he tries for a line of position. Half an hour or less after beginning the study of nautical astronomy he is looking at his first line of position on the chart. This simplicity was not realized at first. In discussions with various navigators the difficulty of teaching a beginner was sometimes mentioned, always with the idea that anything so different from a sextant would be much more difficult to learn to handle. Fortunately the truth of the matter was discovered before too many theoretical conclusions had been drawn. An enlisted man (Maury W. Shannon, Sea lc. U.S.S.*Aroostook*) was curious about the instrument and was allowed to attempt an observation. He had had no previous instruction in nautical astronomy but had no difficulty at all in observing longitudes according to directions. After a few of these he determined two lines of position, both of which passed one and a half miles south of the true position (chiefly because it was 2:15 P.M. on Dec. 22 and no refraction corrections were applied). He had learned the purpose of the three arcs and how to read their verniers and could observe in less time than it usually took an experienced navigator to realize that this was not a "sextant" and required a special technique.

Future Development

After it has been recognized as an avigation and navigation instrument the spherant may make a further advance by combination with a gyrocompass. If a spherant were mounted on or over a gyro repeater in such a

manner that the polar axis could be adjusted to the north and south line and the axis of the leveling device perpendicular to the plane of the card, it would be possible to point the telescope to an astronomical body, in general, only by adjusting both hour angle and latitude, assuming declination to be fixed at its true value. When this adjustment has been made the latitude reading is the true latitude of the ship and the hour angle combined with the GHA is the longitude of the ship. In other words a complete fix is obtained from a single observation. To be of value it would be necessary to have the gyro repeater not only accurate to one minute of arc but its plane level with this accuracy also. This condition is by no means arrived at by any gyro as used at present, not even the remarkable gunnery gyro Mark X. The horizon-type leveling device of the spherant would, however, take care of the second requirement. Under the best conditions at present the uncertainty of the fix in the direction at right angles to the sun would be quite a few miles, just how many is somewhat a controversial matter but the latest gyros certainly make it less than the uncertainty of the dead reckoning after a long run. The important point is, that this section of a Sumner line or approach to a fix would be determined directly from the instrument, immediately after a single observation, and nothing has to be assumed beforehand.

SUMMARY

Summarizing the various points: Equipped with the spherant and *Nautical Almanac* with a page of refractions pasted inside its cover, a navigator needs no other tables for determination of lines of position. The usual work of making several entries in a table with the resulting additions and subtractions, use of parallel rulers and compass rose in laying off the azimuth, dividers for the altitude difference and parallel rulers and compass rose again for the line of position is all eliminated. This is an appreciable saving of time and worry for the surface navigator but is an enormous advantage in aircraft. It makes navigation more fool proof and therefore safer.

Instruction in navigation is greatly simplified. A student obtains results from the start and does not pass through the usual stages of wondering what it is all about. The instrument is seen as a model of the celestial sphere so there are no diagrams to be visualized. Under emergency conditions embryo navigators can obtain sufficient knowledge and skill in nautical astronomy for navigation purposes in a few hours.

ACKNOWLEDGMENTS

In conclusion a few words of appreciation should be expressed for certain individuals, each having been a link in the chain making this development possible:

Captain C. W. Nimitz, U. S. Navy, in 1927, while in charge of establishing the Naval R.O.T.C. Unit at the University of California, was placed in charge of an academic committee of investigation which reported to the University that the idea was worth developing, although the only model available at that time was a complicated collection of mirrors and mechanical devices. On the basis of the opinion of Captain Nimitz the University agreed to have made a more suitable model as a research activity.

Professor Gould of the Byrd Antarctic Expedition, having read a published description, requested the loan of the instrument to the expedition, so the second model was sent to him as soon as completed. This was rather a cumbersome and unwieldy instrument but it pointed the way towards a much more practical design.

Professor A. O. Leuschner, director of the Astronomy Department of the University, who had already been instrumental in smoothing the way for the construction of the second instrument, now made further progress possible by interesting Mr. Ralph Ellis of Berkeley, who provided for the construction of an instrument of improved design for the astronomy department.

The instrument made possible by Mr. Ellis was later taken to the Naval Air Station at San Diego where Lieutenant Commander George R. Fairlamb was of great assistance in testing the instrument under practical conditions and in making constructive criticisms.

Lobsters *and the* Navy

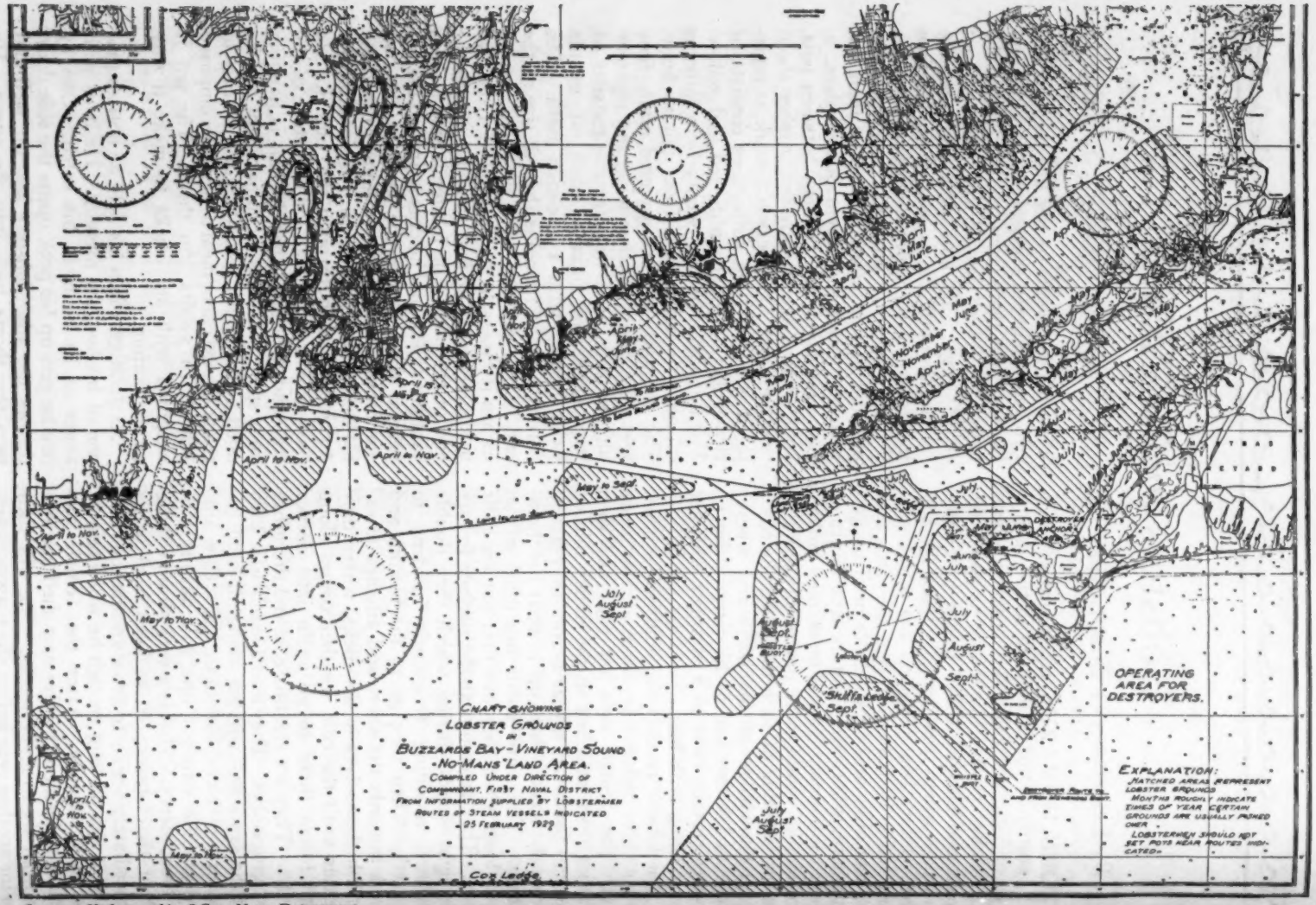
By Lieutenant Commander Richard Stockton Field, *U. S. Navy*

JOHN HOMARUS of Menemsha in a sturdy motor boat is out in the vicinity of Vineyard Lightship to haul his pots. His kicker pushes him along at about ten knots and also furnishes power to a small windlass which lifts the pots from the bottom. John's boat probably has a well constructed in its bottom so that the catch may be kept alive and comfortable until he gets it ashore, where the lobsters will be transferred to a float. If you mentioned biology to John he would in all probability say that he new nothing of such things but he has a good knowledge of the whys and wherefores of lobsters and as he chugs along he relates certain facts to a stranger who has come along with him.

The lobster reaches the adult stage when about eight inches long, three or four years old. The female lays her eggs and then carries them attached to the under side of her tail for about a year before they hatch, when she shakes them off to shift for themselves. They are about one-third of an inch long when they are first put on their own. They remain near the surface for six or eight weeks, during which they double in size, moulting frequently incident to growth. Then they go to the bottom and work towards the shore and attempt to establish themselves in the rocks, where they remain until the cold weather comes along and forces them to go again into deeper water. They are cannibalistic and therefore not gregarious. They lead a lonely life. Two of the same size will get along all right together but if one moults or has a claw amputated the stronger one will devour him without mercy. That is a very strange thing about the lobster; if he loses a claw he immediately begins to grow another one and if he is spared long enough he will again be as good as new. After the female has hatched, she moults. Her new shell hardens in from six to eight weeks. She will then go for another year before she spawns again. Thus the big events of her life are biennial; two years between successive spawnings and likewise two years from one hatching to the next. An 8-inch female will produce about 10,000 eggs; this number progresses geometrically until she is twelve or fourteen inches long, after which it does not increase.

John's pots are on a flat, sandy bottom at about fifteen fathoms. He put them out yesterday, twelve of them in this place, in two rows about ten fathoms between pots. John's buoys are four-by-four timber about two feet long. His personal mark as registered with the state authorities consists of two bands of equal width, red and yellow. For this depth he has twenty-four fathoms of nine thread manila from pot to buoy. The pot itself is a lath-covered crate, four feet long, twenty inches wide and eighteen inches deep. The trap feature consists of two successive funnels made of manila twine netting with a one-inch mesh. The entrance of the funnel is the full size of the end of the pot and in a depth of twelve inches it tapers to an opening of from five to six inches. The first funnel begins at the end of the pot. The lobster is said to be a cautious fellow and he crawls around the pot several times before the smell of the bait and his permanent state of hunger overcome his discretion and drag him against his better judgment in through the funnel. He pushes himself through the first stage of the trap and then finds that the bait is hanging on a spike in a second compartment and he must go through a second funnel in order to reach the excellent meal of semi-decomposed fish which awaits him there. The pot is weighted with six bricks to make it stay on the bottom.

As John gets into his field he notices that one of his buoys is missing. He boils with anger as he hauls in his catch. One by one he gets up his pots, opens the side door, throws the adult lobsters into the well and puts the shorts back into the ocean. He



Courtesy Hydrographic Office, Navy Department

MARTHA'S VINEYARD TO BLOCK ISLAND, INCLUDING BUZZARDS AND NARRAGANSETT BAYS

calls the attention of his companion to a female "in berry," carrying her eggs like tiny grapes attached to the swimmerets under her after body. He carefully returns her to her element that she may continue her peculiar mother function. As he empties each pot he sees to his bait and lowers away again. However, even the satisfaction of a good catch and a high price at the pier does not reduce John's indignation at the loss of one of his pots.

People do not rob lobster pots. It could be done but it simply is not. The unwritten law is stronger than the printed statute. Public opinion would be as outraged as it was against rustlers in the old West. One may break a law here and there with impunity but one does not rob a lobster pot. John Homarus thinks on this and as he meditates his boat is set in motion by a gentle swell from a passing ship. Tracing the source of the wave John's eyes focus on a Navy destroyer; his fists harden and his mouth sets in a firm line as he tells his passenger, "That's what happened to my pot!" John is mad. He gazes off to the westward and sees a group of five or six of these same ships engaged in some sort of maneuvers. They dash along one behind the other until all of a sudden the leader makes a signal and they all turn to the right or left simultaneously and sweep along abreast in a line a mile long. It seems as if by design they come here at the beginning of the lobster season and stay till the end, May to September. And in this mood of resentment John feels that if those Navy fellows were deliberately trying they could not form a worse menace to the lobster industry.

For years this smouldering indignation against the Navy has existed among the lobstermen in the vicinity of Narragansett Bay. They claimed, and probably justly, that during every month of the summer the Navy destroyed hundreds of dollars' worth of their equipment. Lightships, buoys, and other fairway markers were favorite fishing grounds for lobstermen because such places were easy to get back to. A unit consisting of pot, line, and buoy is worth four to five dollars. Consider also the normal expectancy of catch and the labor involved in tending the pots and you see that the fisherman has just cause to grit his teeth over a missing unit. Lobstermen have seen fifteen or twenty destroyers operating in these waters almost every day of the summer and now and then lobstermen have seen one of these ships cut away a lobster buoy, so when you reflect on all these facts you will conclude that John Homarus might well shake his fist at the passing destroyer.

In years past the lobsterman has had no system as to his field. He would go to his favorite bank and stream his pots, sight a near-by landmark or buoy, get an approximate bearing with his crude boat compass and then go on about his other business, generally on the lookout for swordfish. His neighbors and competitors were doing the same thing. From Newport, Block Island, Sakonnet, Menemsha, and every little inlet on that much indented coast, dozens of lobstermen would put out daily to take their share of this popular and profitable crustacean. Each licensed fisherman had his own recorded house mark painted on his buoys. The sea was literally covered with these markers. Regardless of the necessity of steamers passing they were scattered everywhere within sight of land and sometimes ten or fifteen miles from shore where there was a good bank. In clear weather, under the most favorable circumstances, one destroyer, unhampered by the presence of other ships and following necessary, normal sea routes, could successfully dodge the markers only with the greatest difficulty. Every naval officer has the greatest respect for fishermen. Not only that but he is proud to have the good will of those men; he feels a warm glow of comradeship when the passing swordfisherman or lobsterman gives him a friendly wave of the hand. It is unthinkable that a Navy man would by neglect or by avoidable chance destroy the property of a fisherman. But in spite of their best efforts there were times when buoys were cut adrift. When the pots were scattered everywhere a group of ships in formation was bound to hit one now and then and when the heavy fog cut down the visibility it was well-nigh impossible to miss them.

For years the responsible seniors in the Navy have repeatedly urged upon ship commanders and specially upon destroyer skippers the necessity of great care in passing through lobster areas. This concern and the less sympathetic though no less active hazard of polluting the waters of Newport with ships' refuse have come to be the basis of

Courtesy Hydrographic Office, Navy Department
MARTHA'S VINEYARD TO BLOCK ISLAND, INCLUDING BUZZARDS AND NARRAGANSETT BAYS

a sort of seasonal litany, "From damage to lobster pots and from the perils of floating garbage, Good Lord Deliver Us!"

In spite of the best efforts of the Navy, the unorganized efforts we might say, the situation continued to grow more acute. Early in 1929 the fish commission officials of the states of Massachusetts and Rhode Island got together with the commandant of the First District and formulated an organized plan which has already in one season alone resulted in a vast improvement. The lobstermen agreed to restrict their fields to certain areas and the Navy agreed to keep its ships in certain prescribed channels. A large-scale chart of the coast was produced at the conference. The Navy drew lines from point to point showing what channels they must have as a minimum amount of fairway for ships. The lobstermen sketched in their favorite areas, some of which were reserved for the whole season while others were marked to indicate that they were privileged during particular months. This Coast and Geodetic chart was adapted and issued by the Hydrographic Office of the Navy Department showing the lobster areas and ship channels heavily marked in red ink.

Toward the end of last summer we were happy to learn that the lobstermen around Menemsha had noticed an improvement. "You got a map now, ain't you?" we were asked. "Yeah, we got a map," and we took the map ashore and showed it to them. They are a silent crowd towards strangers but they seemed to be pleased with "the map." This whole subject has given the occasion once or twice for some rather unpleasant questioning on the part of self-appointed champions of the fishermen. While accepting the courtesies of the Vineyard Haven Yacht Club last summer we were embarrassed by the remarks of a member who insinuated that the Navy had shown itself indifferent to the hardship it was causing. This same gentleman later expressed complete satisfaction after we had posted a description of the problem and the progress made towards its solution with a copy of the "lobster chart" on the club's bulletin board.

Operating in these waters now on this chart is very much like playing around a mined area in war time, a field here, another there and a safety route or swept channel from point to point. Even now one frequently finds some of the pots carelessly placed in the "safety routes." In such cases it is the usual practice of destroyer skippers to handle their ships as if they were actually in a mine field, seeking to avoid each little marker as if it were a deadly thing to touch. Thus if we suddenly find a buoy under the starboard bow a slight touch of right rudder will throw the stern away and that one is saved. If two or three more show up at the same time it becomes a fascinating game to dodge them, requiring a nice judgment of rudder effect, but it is a satisfaction to exercise one's skill to avoid doing damage to another.

There is some chance of friction even beyond the lobster area. On a smooth glassy day every man who has the equipment goes after swordfish and in doing so they are limited by no agreement, restricted by no chart. They go well offshore. One has spent a whole morning changing the base course frequently, waiting for a favorable opportunity to fire a target practice. We are all set on a southerly course ready to fire to port when a small sail is sighted to the eastward. We change forty-five degrees to the right and perhaps get started when another sail is sighted and we must change again. The chance of hitting such a boat is not the question. If one fires within ninety degrees of him he will go ashore and spread the story that the Navy has been shooting at him, or our much abused brothers of the Coast Guard will be accused of it.

Navy men are not impatient with these fishermen. Anyone with common sense will realize that they are out there on the water to make a hard-earned living. We have the speed and power with which to get out of their way and they should certainly not be expected to get out of our way for ordinary peace-time operations. With all our care and consideration, however, we were rudely shocked last summer when a big black skipper to the southward of No Man's Land passed close aboard and shook his fist at us and demanded to know if we expected him to go ashore to fish!

Joining *the* United States Navy

By CAPTAIN F. H. POTEET, *U. S. Navy*

WHAT career does enlistment in the Navy offer to acceptable young men of the United States? In the first place, the Navy takes young men at the restless age when they are upon the threshold of their careers and offers them a period of four years with pay and maintenance, during which time they may find themselves. They see something of the world, live an outdoor, healthy, active life and emerge self-reliant and strong, prepared to tackle with confidence the problem of making a living. The young man who is provident may go back to civil life at the end of his four-year enlistment with a good nest egg in the bank and with the assurance that his habits of going about his work are such that he will be able to command steady employment. The young man who wishes to continue in the naval service may do so with increasing benefits as time goes on; when still in the prime of life he may enter the Fleet Naval Reserve with a reserve pay sufficient to insure him against distress for the rest of his life and with the mature ability to carry on employment, either by undertaking a business of his own, or by utilizing the trained ability which he will bring with him from his naval service. Such a man has a great advantage over his brothers in industry.

One out of every six of the men who apply for enlistment in the Navy is successful in meeting the requirements. Of the 12,518 men who will enter the Navy this year over 30 per cent will be high-school graduates, over 70 per cent will have completed at least two years in high school, and all will have passed a rigid physical examination.

The Bureau of Navigation in the Navy Department is directly in charge of the selection and enlisting of these men. The Recruiting Division of the Bureau of Navigation is under an officer of the rank of commander, who has charge of recruiting activities throughout the United States. For administrative purposes, the United States is divided into five recruiting divisions, each in charge of an officer of the rank of commander or captain. Each recruiting division has four or more main stations located in the larger cities of the division; each main station is in command of an officer of the rank of lieutenant, lieutenant commander, or commander, depending upon the size and importance of the station. In addition, a naval medical officer and from five to twenty petty officers are assigned to each main station; also, each main station has one or more substations in its vicinity located in the smaller towns; each substation is in charge of a petty officer who investigates possible applicants and sends acceptable ones to the main station for physical and mental examination; if qualified, the applicant is enlisted for service in the Navy. Altogether there are 39 main stations and 234 substations located in all of the states of the United States, the object being to secure applicants from each state and thus make the Navy truly representative of our country.

Any person presenting himself at a recruiting station is called an "applicant"; the applicant must fill out an application blank in his own handwriting, giving his age, whether employed or not, name of his father and mother, and his reason for desiring to enlist; the applicant is then examined by the medical officer. If he is found physically fit, a recruiter verifies his age at the Bureau of Vital Statistics, interviews the persons given as references (two character references or employers' references are required) and then ascertains if the applicant has a police record. The Navy will not knowingly enlist any person with a criminal record. If all of the above is found to be satisfactory, the recruiter next visits the home of the applicant and informs his parents of life in the Navy and answers any

pertinent inquiries—the Navy wants satisfied parents as well as satisfied personnel. No false promises are given; no boy under twenty-one years of age can be enlisted without consent of parent or guardian. The once popular idea that a run-away boy can enlist in the Navy is far from the facts; it is a very difficult matter to enlist in the Navy under present-day requirements and the youth is fortunate who can pass the rigid physical examination and present satisfactory evidence of his mental and moral fitness to serve his country in the Navy. Last year 81,840 applicants applied for enlistment and only 13,719 were accepted.

The applicant, having passed the physical examination, and his evidences of character, age, police record, etc., having been verified and accepted, next appears before the recruiting officer at the main station nearest his home. If found acceptable, he is enlisted and becomes a "recruit," his pay starting immediately. All first enlistments are made for general service and no applicant can be assured that he will be enlisted for any particular trade, school, or duty; his success in any line chosen by himself depends upon his education, aptitude, and vacancies existing at that time.

The average age of recruits taken in the Navy is less than nineteen years. Few of them have learned a trade in civil life and less of them have had service at sea, but they have the same initiative and versatility that have always been shown by the men drawn from American homes in time of national emergency. The great majority of recruits fit themselves into their life aboard ship and learn to perform their new duties so well that the assimilation of from fifteen to twenty thousand inexperienced men each year causes no serious break in the effective operation of naval ships. The Navy does not demand that the recruit taken into its service shall have had previous trade experience. What it does demand is that the recruit himself shall have the character, intelligence, and habits to make him a valuable and dependable member of the Navy's personnel when he has been given the proper training for his work.

After enlistment at one of the main recruiting stations, the recruit is furnished transportation to one of the four training stations nearest his place of enlistment. These training stations are located at Newport, R.I., Hampton Roads, Va., Great Lakes, Ill., and San Diego, Calif. The routine, training, and equipment are practically the same at each station.

The story of how the Navy molds the recruit into a trained man-of-war's man is an interesting one. Recruits come from all walks of life—schools, farms, stores, and factories—and from all sections of the country, and with them come the traditional sectional traits. Some are not responsive to a new environment. The selection, training, and development of recruits require qualities which are recognized universally as desirable but which are cultivated to a far less degree in other walks of life. It is the primary duty of the training stations to lay the foundation for the recruit's future efficiency as a man power of the fleet; to see to it that when he *"shoves off"* to the Navy ships he will be ready to "carry on" intelligently.

On arrival at the training station, the recruit is conducted to the administration building, his record is checked, and the medical and dental officers give him a careful reëxamination as a check against the examination made at the recruiting station; and, if found satisfactory, he is fitted with one complete suit of uniform clothing. The civilian clothing belonging to the recruit is either given to some charitable organization or is sent home, in accordance with the recruit's wishes.

The new recruit now in uniform reports to his company commander, draws his bag and hammock, and is given credit for $100 worth of clothing, which is furnished him free of charge. The company commander supervises the fit of his clothing and instructs him how to stow his bag and hammock. The new recruit is now ready to begin his training and is stationed as a member of a company of 120 new recruits. This same company commander remains in charge of the company until completion of recruit training and then conducts his charges to the ship to which they will be assigned.

For the first three weeks at the training station the recruits remain together in order to detect any contagious or infectious diseases which they may have contracted prior to enlistment. During this detention period the recruit learns about the Navy, boats, signals, knotting and splicing, infan-

try tactics, guard duty, and setting up exercises. This is a very trying period to the new recruit, since he has left his home and has entered an entirely new life. Realizing the effects of homesickness, every effort is made to keep him busy and happy; athletic sports under competent instructors are encouraged, moving pictures are shown, library books may be drawn, and he is carefully studied to determine his future usefulness to the service and his country. The daily routine aims to assure good health, cleanliness, obedience, and contentment.

At the end of three weeks the recruit is transferred to the main barracks, where he continues his training for six weeks more. During this period the course of instruction is constantly expanded, personal restrictions are less, and the recruit is given the opportunity to compete for admission to a number of special training schools; he may try for the Bugler School, the Musicians School, the Radio Operators School, the Electricians' Mates School, the Hospital Corps School, the Aviation General Utility School, the Aviation Special Pilot Class, the Machinists' Mates School, or the schools for coppersmiths, blacksmiths, and boilermakers. At these schools, which vary in length from twelve weeks to nine months, he will receive training to fit him to work his way more quickly into the rating for which the schools prepare him.

Vocational guidance in the Navy is reflected in the methods by which those who compete for these schools are selected. Those who do not desire to go to the schools, together with those who do not lead in the competition, proceed at the end of their nine weeks to sea, where they are later joined by those who went to the schools.

On arrival in the ships, the recruits are placed in the recruit division and are carefully instructed in their new duties by competent officers and petty officers. At sea all of the recruits are again on common ground; attendance at a trade school does not result in attaining a rating. The recruit must earn his rating in actual practice on board ship. Promotion in the Navy is a carefully arranged procedure. Long experience and much study have been combined to produce a standard set of requirements for naval ratings. These requirements form a complete and definite statement of the qualifications that a man must have before being advanced to each rating. Qualifications are progressive, and as a man's experience and knowledge of his trade increase, he must meet a higher standard in order to attain a higher rating, with its corresponding increase in pay.

In ships, the same as at training stations, the recruit is consulted as to the particular line of work he wishes to pursue and is usually placed in a position to obtain his desires. The Navy requires 40 distinct trades, 144 different ratings, and maintains 44 service schools. In addition to the instruction received in service schools and from the officers of his ship, the Navy gives its enlisted men the opportunity to take courses of instruction arranged similar to correspondence courses, but administered by the officers and petty officers of the ships. These courses, 123 in number at the present time, are constantly being improved and are designed to aid each man in qualifying for advancement.

The underlying principles of the trades taught in Navy schools are identical with those taught by civilian schools in connection with the same trades. The naval electrician, radioman, or engineer must know the same fundamental principles of electricity, radio, or steam as thoroughly as men following similar trades in civil life. Frequently their training and practice is more varied and more comprehensive. The Navy does not undertake to teach men things other than those which perfect them in doing the Navy's work. However, the work of the Navy calls for the best that a man has, and when he has produced that, he has developed in himself the most of which he is capable. A man who has served a couple of cruises in the Navy honorably and successfully, need have no fear about gaining suitable employment in civil life.

The Navy's training system does not end with the schools above mentioned and with the training courses. After a man has been afloat and has demonstrated his suitability for some particular work, other opportunities for special training are constantly arising. For qualified men, the Navy conducts schools for those who will work on optical material, for those who are to be listeners with the sound apparatus, for advanced instruction in radio material, for torpedomen, for cooks and bakers, for stenographers, for deep-sea divers, for pharmacists' mates, for

electricians who desire to qualify in gyrocompass work, for aviation machinists' mates, for photographers, for fire-control men, and for men who maintain aviation instruments. Qualified men are trained as aviation pilots, or are given training for submarine work. There is special training in motion-picture operation, in gas masks, in aircraft armament, etc. Then, too, the warrant officers of the Navy are drawn from those who have been successful as enlisted men. And each year, not over one hundred enlisted men may be admitted as a result of successful competitive examination to the United States Naval Academy as midshipmen.

Highly developed and specialized equipment calls for a corresponding specialization of the men who operate it. Navy men are first of all seamen and resourceful. Having attained that qualification they specialize. The engines and boilers of the ship, the dynamos and other electrical equipment, the fire control and vast amount of ordnance equipment, the airplanes and their engines, all must be in charge of men specially trained for that responsibility. In keeping up the vast number of trained men required to do its work, the Navy has learned to place its reliance upon the initiative and intelligence of American youth. It has learned from many years of experience that the best type of American youth is able to fit himself for any reasonable responsibility, when proper encouragement and opportunity are given him. The most valuable man for the Navy is the man of good character and intelligence, who enters the service young and learns his trade in naval schools or on naval ships.

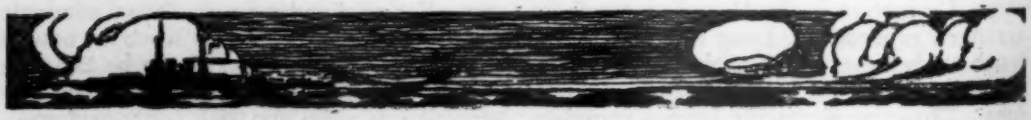
Some of the benefits which fall to the lot of every Navy man during his enlistment are: His pay starts the first day of his enlistment. He has the benefits of expert medical and dental attention. A modern sick bay, dental room, and operating room are on each large vessel. Well-equipped hospitals are maintained on shore for naval personnel. A hospital ship is attached to each fleet. The Navy buys the very best food obtainable and trains its cooks and bakers in special schools on shore. A large ship has athletic teams in practically all of the sports recommended and in use by colleges. Qualified coaches are selected from the graduates of the Naval Academy and from the enlisted personnel. A large reading room with library is on board every large ship and moving pictures are shown nearly every night. All of the above is free to the enlisted man and is in addition to his pay.

That the men in the naval service appreciate their opportunities is attested to by the fact that 72.8 per cent of men who were eligible reënlisted for further service during the past year.

Some young men do not find Navy life agreeable and are separated from the service during the first year of their enlistment. The great majority, however, remain with the service and obtain the benefits of retired pay, with increased earning power.

Enlistments are all voluntary but the enlistment once made and the oath taken by the recruit, he is not released from that service to which he has agreed, without a very excellent or extraordinary reason.

It can be safely said that no institution or organization in the world is called upon to do such intensive and varied training as the American Navy and it is also true that no trade school or training institution is in a position to offer its men under instruction such complete equipment facilities. The Navy is keeping pace with the strides being taken in civilian educational work so that our naval personnel will be the best trained and educated sailormen in any navy in the world.



Courtesy Captain F. H. Poteet, U. S. Navy *Navy Department photograph*

CREW OF A UNITED STATES BATTLESHIP IN SWIMMING

UNIV. OF MICH.

Courtesy Captain F. H. Poteet, U. S. Navy

ENTRANCE TO THE U. S. NAVAL TRAINING STATION, GREAT LAKES, ILL.

Courtesy Captain F. H. Poteet, U. S. Navy

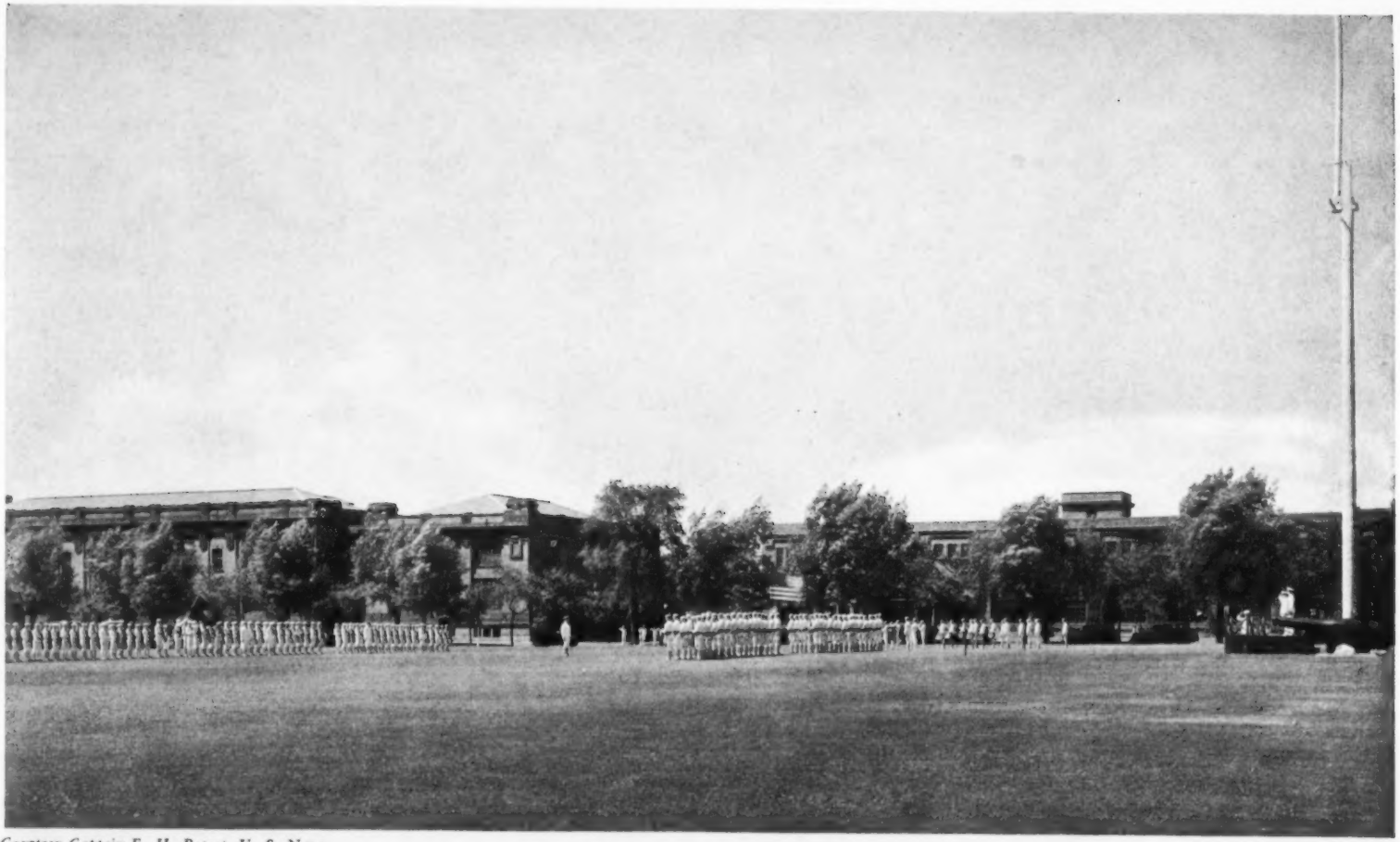
SETTING-UP EXERCISES ON BOARD A BATTLESHIP

Navy Department photograph

UNIV. OF MICH.

Courtesy Captain F. H. Poteet, U. S. Navy

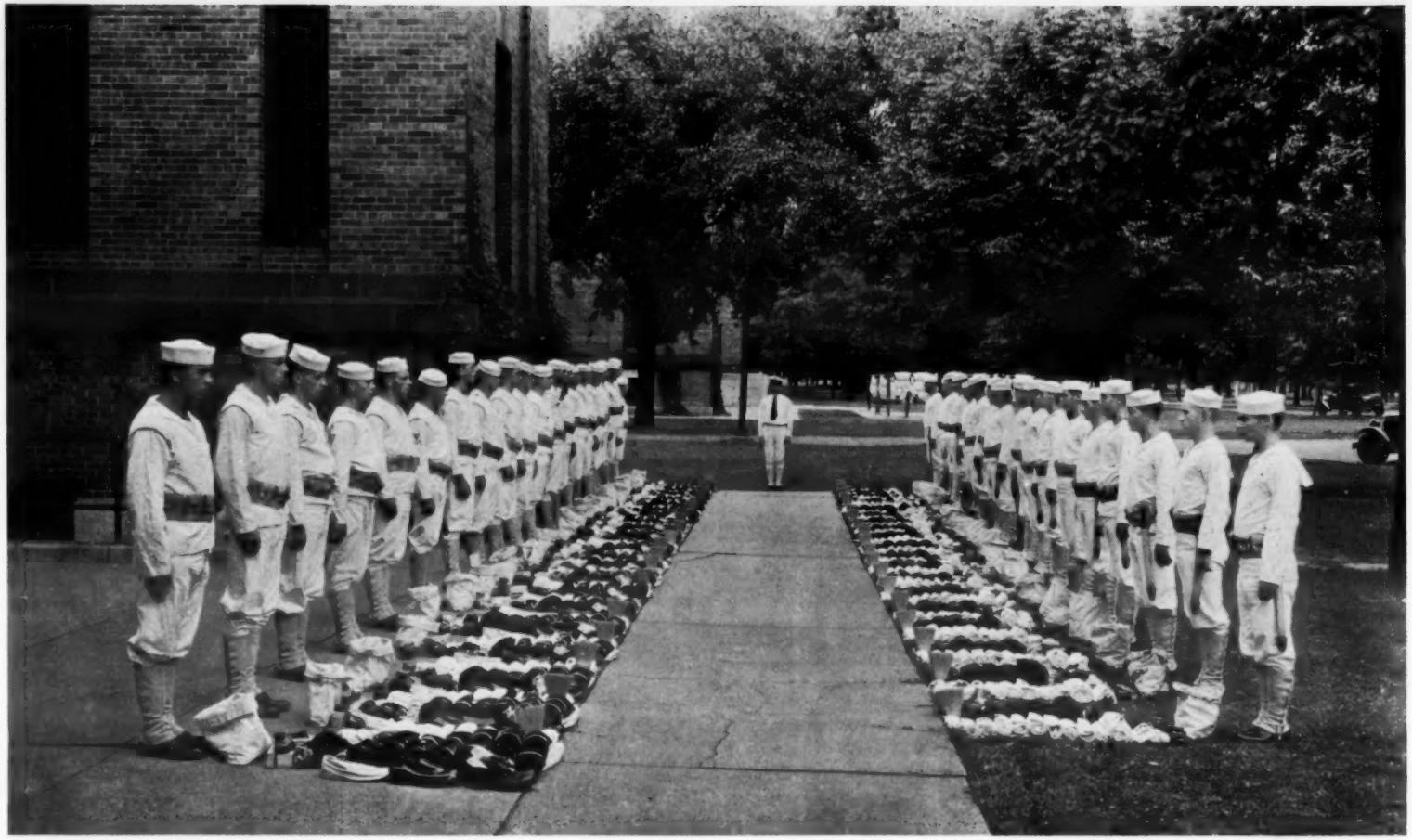
LIVING ROOM IN BARRACKS "A," U. S. NAVAL TRAINING STATION, GREAT LAKES, ILL.



Courtesy Captain F. H. Poteet, U. S. Navy

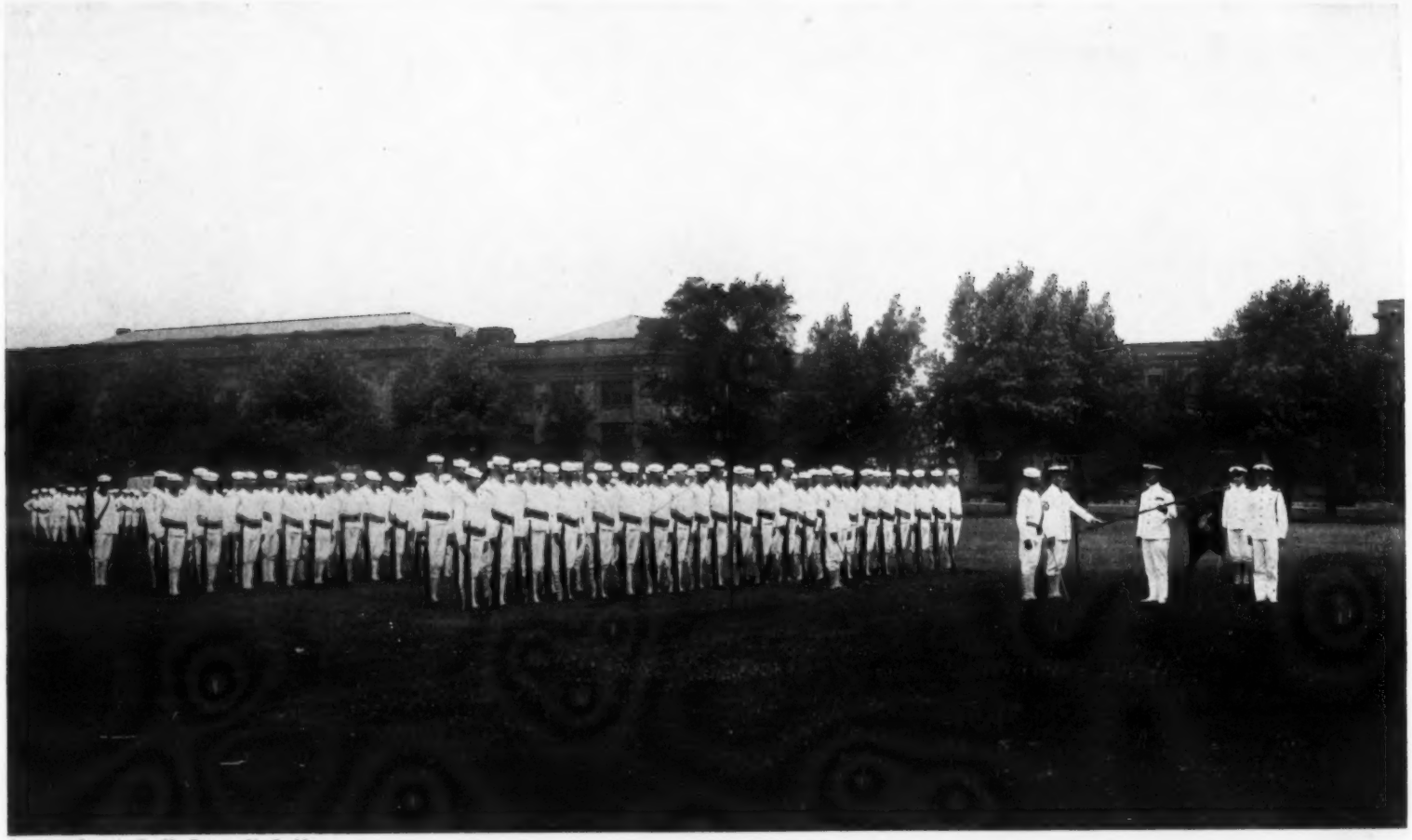
PRESENTATION OF COLORS AT DRESS PARADE, U. S. NAVAL TRAINING STATION, GREAT LAKES, ILL.

UNIV. OF MICH.



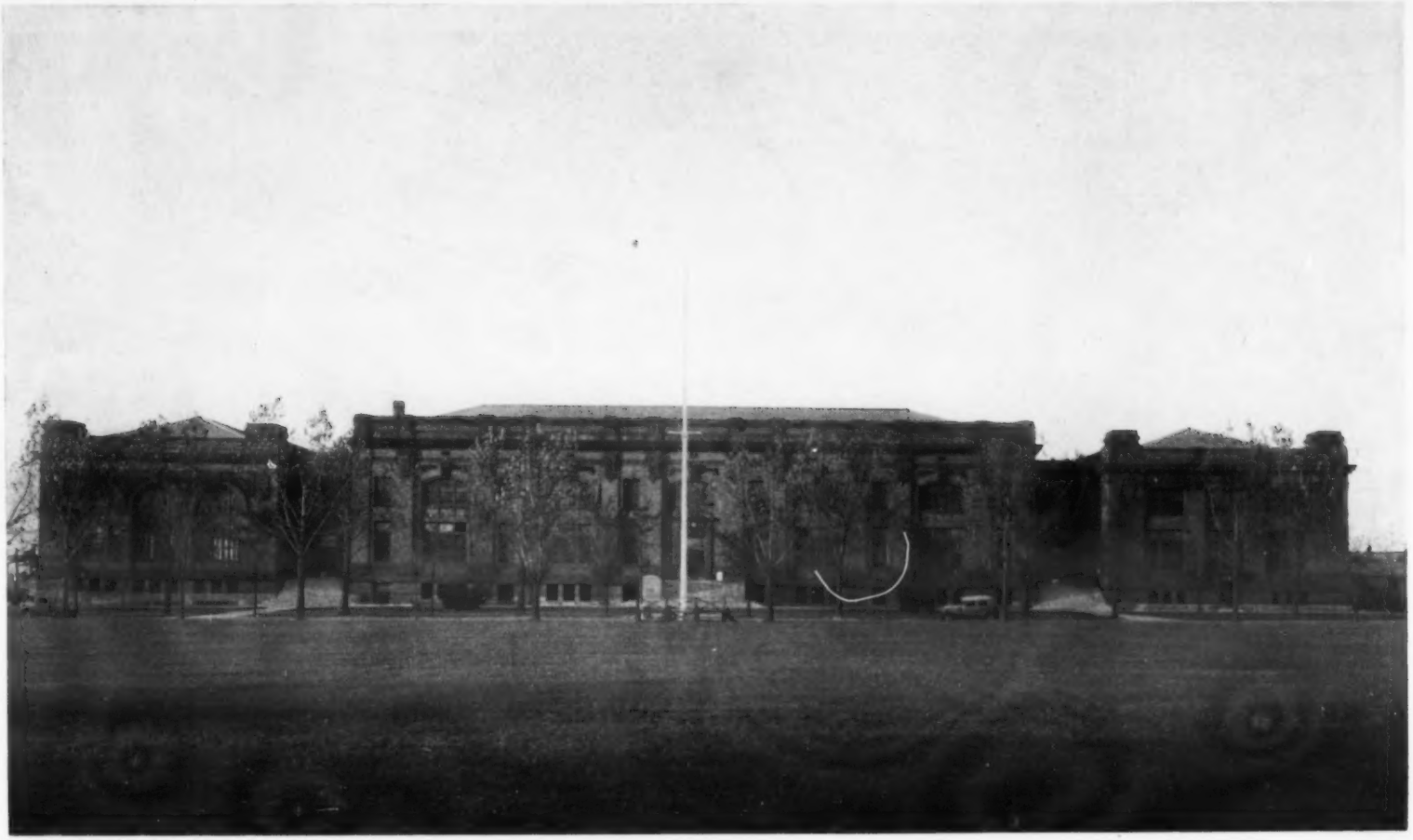
Courtesy Captain F. H. Poteet, U. S. Navy

RECRUITS AWAITING BAG INSPECTION, U. S. NAVAL TRAINING STATION, GREAT LAKES, ILL.



Courtesy Captain F. H. Poteet, U. S. Navy

PRESENTATION OF ROSTER PENNANT TO THE MOST EFFICIENT COMPANY OF RECRUITS, U. S. NAVAL TRAINING STATION, GREAT LAKES, ILL.



Courtesy Captain F. H. Poteet, U. S. Navy

INSTRUCTION BUILDING, U. S. NAVAL TRAINING STATION, GREAT LAKES, ILL.

Damage Control

By LIEUTENANT COMMANDER ROBERT B. CARNEY, *U. S. Navy*

WITHIN the past decade interest in damage control has increased noticeably; the first requisite of a fighting ship is that it remain afloat, and appreciation of this axiom has gradually led to a better understanding of the necessity for the organization and equipment with which all phases of damage may be met and neutralized.

Design and construction have of late years conformed to the newer conception of stability and water-tight integrity, and the forces afloat have gone into the subject of water-tight integrity in great detail. The latest and most important addition to the important subject of damage control has been contributed by the *Manual of Interior Control.* Having, as it does, official sanction, the manual has definitely given the subject of damage control a status which insures recognition and definite action toward the end that ships will be organized and equipped to meet and control damage in all of its phases.

Prior to the issue of the *Manual of Interior Control,* the service came to be familiar with the reports of the Fire Control Board and Ship Control Board. Ship control was a general cover-all which included practically every angle of control that could not be classified as a fire-control matter; the new conception of ship control recognizes that there are two important and distinct functions embraced under that heading: maneuvering control and *damage control.* The navigator is now considered to be the maneuvering officer instead of the ship-control officer as heretofore; the damage-control officer is responsible for that part of ship control relating to the control of damage in all of its various forms.

Damage control, itself defined as a phase of ship control, may be further divided under five subheads: stability control, gas defense, fire fighting, repairs, and care of the wounded.

In every ship some officer is charged with the responsibility of coördinating damage-control matters; in large surface vessels the first lieutenant is the damage-control officer; in destroyers the executive officer acts in that capacity; the depth-control officer of the submarine is the damage-control officer in that type; and in the large dirigibles damage control comes under the jurisdiction of the keel officer.

In ships having a central station, damage control is coördinated from that station. The officers in charge of the repair stations forward, amidships, aft, and on the upper deck act as assistants to the damage-control officer. The damage-control officer exercises control over this function by means of the 2JZ (casualty repair) battle telephone circuit and such parallel communications as exist. The damage-control officer reports directly to the commanding officer and cooperates with the battery-control officers, engineer officer, etc., in damage matters as necessary.

STABILITY CONTROL

The first lieutenant, as damage-control officer, coördinates the various activities of the stability-control organization in large ships. In smaller vessels this, of course, is modified as shown in a foregoing paragraph. There is prepared for each ship a table showing the change in list, trim, and draft, caused by flooding the various compartments of the ship. This table together with small plans, suitably arranged, is located in the central station and the whole is known as the casualty board. In certain ships provision has been made for the remote operation of flooding valves and these devices have been located in a single compartment known as the wing-tank control room. In ships having the wing-tank control room there is a duplicate casualty board and the officer stationed in that compartment is directly charged with the duty of stability con-

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trol under the supervision of the damage-control officer.

The damage-control officer exercises supervision over the control of stability from the central station, using the 2JZ battle telephone circuit which connects him with all repair stations, and with those flooding stations which are habitually manned in battle. The officers in charge of the wing-tank control room and repair parties, and the personnel at flooding stations which are habitually manned in battle, will exercise control in the areas in which they are stationed, but are at all times under the direct orders of the damage-control officer and at all times must keep him informed of the situation, as he must coördinate all stability-control activities in order to keep the ship on an even keel.

Those compartments under the cognizance of the engineering officer, such as the fuel-oil tanks, etc., should be flooded and pumped under the direction of the engineering officer, but with the advice of the damage-control officer when stability is affected; conversely, when the damage-control officer has occasion to change trim by means of flooding or pumping out compartments or tanks under the cognizance of the engineering officer, he should inform the engineering officer of such necessity and request that the necessary action be taken. Should the engineering officer disagree with the recommendation of the damage-control officer in the case of compartments and tanks under the cognizance of the engineering department, the captain must decide the action to be taken.

The subject of water-tight integrity is closely related to stability control and the damage-control officer must be thoroughly familiar with all the appliances and methods of maintaining the water-tight integrity.

GAS DEFENSE

At the present time the methods of protecting personnel and material against the effects of war gases are far from being perfected. Difficulties arise and make it necessary to compromise in many cases in order that the military virtues of the various types be not altogether lost in an effort to protect them from this menace. In general, it may be considered that there are five degrees of gas protection:

(1) Complete protection, involving gas-tight sealing and the cooling, purifying, and recirculation of air;

(2) Protection afforded by gas-tight sealing together with the use of soda lime, and the supply of oxygen from special containers;

(3) Temporary protection afforded by sealing compartments gas-tight during the period of the attack;

(4) Prevention of the entry of gas into a space by maintaining that space under a pressure;

(5) The protection afforded by gas masks and specially designed clothing.

The introduction of gas filters may be employed in the fourth case and in certain other instances.

In arriving at any definite policy in the matter of prescribing gas protection, the weight, time, and cost factors will inevitably lead to a comparison of types with the very natural result that the same protection cannot be guaranteed to the destroyer, for example, as the battleship. It is doubtful if such a policy allows of a more definite statement than the following:

The personnel of each station should be afforded the maximum gas protection compatible with the type of service expected of the ship, the importance of the station in the battle organization, the structural characteristics of the station, and the weight, space, and expense involved.

Following that formula, the degree of gas protection has been determined for the various stations in all classes of vessels. Assuming that complete protection for all personnel is not practicable, we must face the fact that a large percentage of the ship's company will have to rely on masks and gas-proof clothing for protection.

In view of the fact that gas masks in their present form admittedly reduce the efficiency of personnel at battle stations, the authority to sound the gas alarm should be vested in the captain only. Masks may be put on or other gas-defense measures may be adopted locally as directed by the officer in charge, but the alarm putting the entire ship in a state of gas defense must not be sounded indiscriminately.

The first lieutenant, as damage-control officer, is designated as gas-defense officer. He concerns himself with the gas integrity of the ship, the officers in charge of repair parties acting as his assistants when battle

stations are manned. The casualty board contains all pertinent information regarding the degree of gas-tightness of all parts of the ship. In case of gas attack he should demand and receive reports concerning the condition of personnel and material after gas stations have been manned.

A distinctive note transmitted over the general announcing system is considered an efficient gas alarm and one that should be effective and practicable.

Immediately upon detecting the presence of gas at any station the personnel of that station should don masks, and the officer in charge should report direct to the captain if direct communication exists; otherwise to the appropriate control officer, who in turn will report to the captain.

If, in the opinion of the captain, the gas alarm should be sounded, he will cause it to be sounded, and immediately thereafter the control officers of all units of the armament and the control officers of all the major ship-control activities will report to the damage-control officer the condition of personnel and material under their control.

After receiving reports from all parts of the ship the damage-control officer will take such corrective steps as may be possible and will keep the captain, chief fire-control officer, and engineer officer fully informed of all developments, casualties, and progress in overcoming the gas menace.

Fire Fighting

The matters of fire prevention and fire fighting require little special mention. Even in Nelson's time "general quarters" called for leading out fire hose, filling gun tubs, wetting the blanket curtains over the magazine doors, wetting down bulkheads and overhead beams, manning the pumps, and unlocking the magazine flooding valves. Fire prevention and fire fighting are drummed into every man at every station in every ship so that local measures may be taken until the full resources of the ship can be brought to bear. Here again, the damage-control officer and his assistants control major activities and no further description is necessary here in view of the detailed manner in which this subject is covered in the safety precautions and elsewhere.

On the aircraft carriers special precautions are taken in the hangar and on the flight deck and a fire-integrity watch is maintained owing to the tremendous fire hazard on ships of this class and the dire consequences possibly resulting from fire in the vicinity of the great amount of inflammable material on board.

Repairs

On capital ships there are four repair parties under the jurisdiction of the damage-control officer: forward, amidships (engineers'), aft, and upper-deck repair parties. Battery repair parties are authorized but are not normally under the control of the damage-control officer.

The damage-control officer supervises repairs through his assistants by means of the 2JZ telephone circuit, his assistants in the various areas carrying out his orders and reporting progress and general conditions. He coöperates with the engineering officer in the matter of supplying assistance to the amidships repair party for hull damage owing to the fact that the amidships repair party is primarily concerned with repairs under the cognizance of the engineering department.

In small ships the repair organization is modified to meet the personnel situation and special characteristics of the ship.

Care of the Wounded

The battle dressing stations are manned by the medical department but are a part of the damage organization, owing to the fact that movement of the injured may involve opening water-tight subdivisions of the ship, and also because the employment of crews in reserve may be affected by casualties in large numbers. The damage-control officer exercises control over such of the battle dressing station activities as concern him by means of the 2JZ circuit.

In the foregoing paragraphs, damage-control methods have been discussed as accomplished facts; without doubt much that has been said will have an unfamiliar ring to damage-control officers earning their respective livings as such in the fleet. However, I have outlined the principles that are now sanctioned and approved—principles which will in the future govern material installations and battle bills, and it is fondly hoped that this brief discussion may be of assistance in interpreting the intent and provisions of the *Interior Control Manual*.

Radio Competitions

By JOHN ROBERT JOHNSON, C.R.M., *U. S. Naval Reserve*

THE subject of competitions is causing quite a bit of discussion and rightfully so, because while in certain instances the principle of competition is good, in actual practice the competition itself may become a detriment. The idea of placing various units on a competitive basis is not new. It has, under certain conditions, been a result producer for hundreds of years. But it is well to remember that a competition is successful in direct proportion to its simplicity.

When any competition is loaded down with complicated rules, handicaps, and multiples, its success is jeopardized, due mainly to two reasons. First, the personnel involved do not fully understand the situation and lose interest; second, the framers of the rules are prone to lose sight of the ultimate object to be attained and consequently the competition does more harm than good.

In order to show how it is possible for a competition to be harmful it will be necessary to consider the case of a radio station that has an average delay of, say, six hours on a certain circuit. This station—after the average delay on that circuit is ascertained—is given a "multiple" for the circuit which operates as a handicap to give that station an even chance in winning.

Thus, a station that actually delays messages for six hours *may* win out in competition over another station that has an average delay of only thirty minutes. When this happens the station is commended for good work, whereas the station is actually less efficient than possibly several others, where the delay was really less but the multiple correspondingly low.

The personnel at the winning station point proudly to the fact that they won the competition and forget the convenient multiple that made their success possible. If an effort is made to reduce the multiple, all hands rave about atmospheric conditions, the noise level, poor material, and what not, and do everything under the sun to prevent the multiple from being changed. They want to win the competition next year.

Before the competition came, radio men strove earnestly to cut down on delays, *no matter what the cause*. If a certain transmitter had a habit of going "hay wire" and unreadable at certain times of the day, the chief gave the material gang no rest until that transmitter was improved to where it was capable of 24-hour service. If the set proved hopelessly inadequate, they either built another transmitter or had another installed by the long-drawn-out, but necessary, method of "putting in for it."

But since the actual delay has been conveniently whitewashed by a multiple, there is no reason to try for increased efficiency. The multiple makes all men equal and is a convenient help for a lazy or incompetent radio unit.

Now it is admitted that a competition is a good thing at times, but when it substitutes a multiple for efficiency there is room for a reasonable doubt as to how much good that particular competition is actually doing.

The radio competition has been discussed frequently and, at some point in the discussion, those in favor of the competition always drag in the gunnery competition and point to what it did for gunnery. There is no reason to doubt that the gunnery competition was, and is, good; but it can hardly be compared with the radio competition.

In the gunnery competition such matters as wind, roll, and visibility can be measured and an allowance provided in the form of a multiple because we can't stop the wind or roll nor improve the visibility. But in radio we *can* decrease the delay that arises from a faulty transmitter or receiver, even if it is necessary to install another and more powerful one to do the work.

It has been suggested that the only real comparison for the radio competition would be found in a surgical competition, wherein each doctor is assigned a personal multiple to offset his lack of skill in certain lines. Thus one surgeon would have a handicap of six on appendicial operations but only two in tonsillotomy. He might lose six appendicial cases before it started to count. Sounds foolish, doesn't it? It is. But what of the theory that gives a station a multiple permitting four hours' delay on a given circuit before it means anything.

Of course we might hand the enemy eight brownies in time of war if he attacked before the delivery of an important message, which had only been held up three hours, when everybody knew that the multiple for the relaying station was four hours and thirty minutes. We could call the enemy's attention to the fact that we were not prepared for the attack because he did not respect the four-and-one-half-hour multiple of the relaying station and that he should declare that attack only a rehearsal run and go back and do it over again.

A certain radio repair officer observed that some of the ships' radio rooms were apparently only cleaned up for Saturday inspections and the apparatus was in the habit of refusing duty without notice. Some of the receivers would quit cold and the operators would jar them with a few well-placed wallops until they came to life again.

On other ships the radio rooms were always neat, clean, and orderly. The receivers were always in condition and did not have to be rejuvenated with short-arm jabs at frequent intervals. The condenser plates never scraped and squawked due to lack of "pig tails" or because of buckled plates, and it would have been reasonable to suppose that one of these well-cared-for installations would win the competition.

During a tour of duty lasting nearly three years, it was noted that the competition was won each time by one of the vessels whose apparatus was of the poorest. Such items as circuit breakers being held in by swab handles, meters that had been out of commission since the war, receivers that had to be tuned and then not touched for fear they'd quit oscillating, dirty insulators, and other items too numerous to mention, were observed on winning vessels.

Of course, more than one competition has been won on paper, but the effect of such competitions is bad. It reacts to the detriment of personnel. They may be pardoned for getting the idea that a clean radio room, efficient apparatus, and attention to duty do not mean anything. When they see a ship, whose poor apparatus and mediocre operators are a byword, walk off with first honors, they begin to wonder, "What's the use?" which is, of course, not the proper way to look at it; but operators are human.

There may be a question in the minds of some as to how it is possible for an inferior installation and crew to win over a better unit. The answer is that winning a competition is a business in itself, and the radio unit that bends all its energies to winning, studies the rules carefully, and forgets everything but the competition, is at least in line for first place, although communications may suffer in the process.

Further details are necessary to explain this. For instance, one division clubbed together to insure that their division would stand first and that one vessel of the division would win. They treated each other very leniently in the matter of "TFC's" (time first called) and sent numerous unnecessary messages to each other to make sure that their average would be high. Their logs showed that the time between the first call and the receipt was short—very short.

One squadron leader had to cover two frequencies simultaneously. They had ten operators to provide for a two-man watch. To make things easier they only kept one man on at a time, which made it difficult for them to copy two messages at once. This difficulty was overcome by refusing to give an "o.k." for a message if the TFC was more than two minutes previous. This one operator guarded the frequency of the next senior continuously and would even stop copying a message from a junior vessel in order to answer the senior promptly. If the junior later insisted on putting the TFC on the message, as of the time he *actually first called,* the operator on the squadron leader would refuse to acknowledge for the message until the TFC was changed. Nice piece of highway robbery, but they made it stick and what is more to the point, they won the radio competition!

There are more ways of winning the radio competition than have been dreamed of by the framers thereof. A recent article in

the PROCEEEDINGS, concerning the various means resorted to by engineer officers to improve their standing in the engineering competition, cited a few of the dodges used. It was very interesting and most of us have experienced downright hardship due to lack of steam heat, light, hot water, etc., all because the engineer officer was enthusiastically doing his best to stand well in the engineering competition. But the various schemes resorted to by radio operators are usually of a nature that would only be detected by operators.

One radio station formed the habit of sending press each night to every vessel they could "raise." They put a transmitter on that particular work, lined up everybody they could get to answer, and sent out whole pages from local newspapers. It was true that the majority of this press had absolutely no value except locally, but it boomed the number of words handled daily by the station and gave them considerable edge over other stations in the competition.

The director of Naval Communications once issued orders to establish a high-speed automatic circuit between two of the larger shore stations. The apparatus at each end was in excellent shape and the operators had received training in the use of automatics. But the attempt failed. The district communication officers and material assistants were doing their best, but the operators soon found that the actual number of words handled—during the first few days of the test—was somewhat less than the previous number. This was due to their unfamiliarity with automatics and to lack of experience in automatic methods.

As soon as the operators noticed this slight falling off in words handled, they became antagonistic and would resort to the old familiar hand methods at every opportunity. As soon as the automatic technician left at 4:00 P.M., the automatics would go "hay wire" and hand methods would be used until his return next day. The attempt to establish the automatic circuit failed, due solely to the competition.

Now it is easy to find fault with anything. The habit of picking things to pieces is a human failing, but such action must precede any improvement. The only *bad* criticism is that which fails to point the way to something better. Frankly, the situation with respect to the radio competition is difficult. After eighteen years experience in communications, the writer can offer nothing in the shape of a *continuous* radio competition that would result in an improvement. It is too much like holding up false gods to substitute a competition for professional pride.

If a competition is felt to be an absolute necessity, it would be preferable to hold it at a stated time each year, get it over with, and leave the rest of the year free for the carrying on of communications, without the handicap of a multiple in any shape or form. The profession of radio telegraphy is sufficiently complicated without an ever-present set of competition instructions over which to waste valuable time.

The following observations are the result of a long and serious study of the situation, both ashore and afloat:

(a) Professional men, specialists, do not do their best work when placed on a competitive basis. Radio is a profession and good operators are specialists.

(b) A specialist is no better than his training and education and a good operator is never "drafted"—he will seek the job.

(c) The first thing to teach an operator is: "Accuracy is the key to speed—and secrecy is the product of both."

(d) The student must be selected with care and the teacher with more care than the student.

(e) A man cannot become a good naval operator in six months even under the best teachers.

(f) High ideals and devotion to duty are not fostered by a competition but by instruction, precept, and example.

(g) Competitions are useful when dealing with individuals of the laborer class wherein a prize is substituted for interest in work well done.

(h) A man seldom becomes a good radio operator when his instruction begins after the age of twenty.

Based on the above, the following conclusion is offered: take students at the age of seventeen—or thereabouts—train them properly, and then, by your own example, give them a high mark at which to shoot, and you won't need a competition. Stated differently: a competition will not inculcate a spirit of professional pride, nor is it a substitute for leadership.

The Cause *of* Battery Explosions

By LIEUTENANT HARRY A. GUTHRIE, *U. S. Navy*

THE ever-present hazard of storage-battery explosions in submarines has never seemed satisfactorily explained. My interest in this subject was increased during a postgraduate course in Diesel engines and storage batteries. In connection with this course an inspection of the Gould Storage Battery Company was made. At that plant, tests were being made on submarine storage-battery cells. A temporary and open ventilation duct had been installed. Sparking occurred within this ventilation pipe. From this observation, I drew the conclusion that the same sparking probably occurred in the ventilation ducts of a submarine. It seemed possible to devise some method of measuring the voltage that caused this sparking. An opportunity presented itself to conduct a research when I was ordered as division engineer of Submarine Division Eleven. Using this sparking as a hypothesis, I endeavored to prove its existence, magnitude, and result.

When a lead-acid battery is charged, about 80 per cent of the current goes into useful work. The specific gravity of the electrolyte rises as the sulphate is forced from the plates. However, a certain portion of the current breaks down the water of dilution in the electrolyte into its component part, H_2 and O. As the state of the charge progresses, less current becomes useful energy and more current is available for the breaking down of water electrolytically. Thus it may be seen that hydrogen is present in appreciable quantity. If air contains about a 4 per cent mixture of hydrogen, an explosive mixture is formed. This mixture will not explode unless the temperature is raised by heat as from the presence of a spark or fire.

Records show that there have been twenty-two battery explosions in our submarines. Each explosion has been followed by a board of investigation or a court of inquiry. The findings of these various boards invariably have been: "Explosion occurred due to an explosive mixture of hydrogen and air present in the system becoming ignited and exploding." The second finding is in almost every case: "The spark necessary to ignite the explosive mixture is always present in a submarine battery." No board has ever fixed the source of this spark. It has been universally accepted that the spark could come from any number of sources. It is the purpose of this discussion to show that the spark can come from only one definite source.

Because the source of the spark was not fixed, all preventive measures have been along two lines:

(1) Installation of a blower system of such capacity as to prevent the accumulation of hydrogen in explosive percentage. This system derived its power from a separate circuit to increase reliability.

(2) Explicit instructions issued by the Bureau of Engineering for charging batteries. These instructions were based on the data obtained from past explosions and test charges.

Despite these precautions, the spark still remains. Should a blower stop at any time, due to failure in the electric circuit, hydrogen accumulates rapidly enough to form an explosive mixture. Every condition necessary for an explosion is present whenever a blower is run too slowly or stops while the batteries are nearing the completion of a charge.

A submarine battery consists of one hundred and twenty cells divided into two groups of sixty cells each. Each group is arranged in four rows of fifteen cells. The ventilation of each group is identical. The cells of a group are placed in a lead-lined tank covered by floor boards. To prevent water from entering the tank a rubber and canvas covering is placed over the floor boards. Brass strips secure this rubber deck cover to the side edges of the lead-lined tank.

Air enters the space between the floor boards and the cell tops by means of two air inlets at one end of the tank. The blowers are located at the opposite end of the tank. Each blower is enclosed in a lead-lined pipe that enters a lead-lined box. Two hard-rubber ducts connect to this box. Each duct runs over the tops of the cells between an outboard row and the next inboard row to the air inlet end of the tank. The ducts are closed at this end. Individual cells are connected to these ducts by rubber nipples. When the blowers are running they place a suction on these two ducts. Air enters the air inlets and passes over the cell tops. By means of four breather pipes on each cell the air enters the cell top. It passes over the electrolyte, cooling it, and is drawn out through the rubber nipple into the hard-rubber duct. The air passes from the ducts into the lead-lined box and thence to the blowers. The blowers discharge to a common pipe which exhausts to either the compartment or overboard.

Battery exhaust gases are usually termed evaporation. The product of evaporation is a gaseous matter consisting of water vapor and hydrogen gas holding in suspension minute particles of electrolyte. This mixture is carried away by the ventilation system. The electrolyte usually deposits in the ducts and ventilation system prior to discharge, forming an acid film which is a conductor of electric current.

The external surfaces of a cell cannot be kept free of acid. Due to seepage, spray, watering, and sweating, a moisture path is formed along these external surfaces to the hull of the ship. Hence a moisture ground exists at all times to the hull. As the ventilation discharge overboard is metal and connected to the hull, it is obvious that the ground extends up to this point. If electrolyte is deposited in the vent ducts in sufficient quantity to form a current path, there is no reason why this ground cannot back down this new path along the vent duct surfaces.

The ground-recording instruments are so connected that they read the ground from the external surfaces of the cell to the hull. No device exists to measure the voltage through this new path. In order to determine the possible existence and magnitude of such a voltage ground, a portable voltmeter was used. One lead was placed inside the cell where the rubber nipple connects to the vent duct. The other lead was placed on the metal at the discharge overboard. The existence of a current path was definitely proved as a reading on the voltmeter was obtained on the first trial.

The first reading obtained was 1.4 volts which was prior to starting a charge. After a charge had been started this voltage rose to 65 volts before the end of the first hour. Before the completion of the charge the voltage had increased to 85 volts. Subsequent trials showed the initial voltage to vary from the original 1.4 volts to as high as 40 volts. Final voltages at the completion of charges were obtained as high as 96 volts. On every charge this voltage ground increased as the charge progressed.

Much data was accumulated on tests but it only proved the existence and magnitude of the voltage ground. It was necessary to prove that the path was broken periodically to cause the 85 or more volts to arc with sufficient heat to ignite the explosive mixture. The first theory evolved was expressed as follows:

When the battery blowers stop on a charge, hydrogen accumulates at such a rapid rate that an explosive mixture soon forms. If a blower should be started with such a mixture present, the acid film would suffer the same effect as the surface of a lake when a strong wind blows over it. There would be ripples that would make and break the normal ground path and cause an arcing to take place at the break. As a result of the above arcing an explosion would follow.

This theory became known as the "Ripple Theory." It was sent to the Bureau of Engineering in the above form. It was requested that this theory be tested at the Naval Research Laboratory, Bellevue, Anacostia, D.C. This same letter suggested a device for testing the theory. In the tests at Bellevue a device almost identical to the one suggested was used. Soon after this theory was expounded, Dr. E. G. Lunn of the Division of Physical Chemistry, Bellevue, was on board the U.S.S. *Holland*. The experiments were later conducted by Dr. Lunn at Bellevue. The theory was discussed with him while he was on the *Holland*. The additional possibility that certain sections of the duct obtained a thinner coating of electrolyte than other sections gave rise to the fact that the path varied in resistance

throughout its length. Thus the I^2R heat loss at a thin section was probably great enough to evaporate a section and cause a break with the resulting voltage arc.

At a later date correspondence was received from Bellevue requesting detailed information. Test data and additional assumptions were furnished. Emphasis was placed on the fact that, regardless of the rippling effect of the fan, the important feature was the acid film acting as a ground conductor and, hence, due to possible interruption of any kind, furnished a fruitful field for sparking.

To test out these theories Bellevue Laboratory performed the experiments in the order enumerated:

Experiment No. One.—A piece of hard-rubber pipe, similar to the type used aboard submarines, was fitted with internal electrodes, and the electrodes connected to a 110 volt D.C. line. The inside surface of the pipe was then liberally coated with electrolyte and the current turned on. After a few minutes distinct arcing was visible at several places on the inner surface of the pipe. This arcing heated the rubber surface sufficiently to cause it to ignite and char.

From this it was observed that acid film is a conductor of electric current and that unless the coating of electrolyte is being continuously renewed, the film will break causing arcing and evolve considerable heat.

Experiment No. Two.—The above piece of hard-rubber pipe was placed in a bakelite tube with a fan attached through which it drew air. A lead was constructed so that an explosive mixture of hydrogen could be introduced into the tube. With the fan running, the current of 110 volts on, and the rubber wet with electrolyte, hydrogen was admitted. An explosion immediately occurred. This was repeated several times with identical results. The fan was then stopped and the experiment repeated without the fan running. Explosions were again obtained without the fan running. From the above it was deduced that the action of the air current induced by the fan had no controlling effect on the explosions obtained.

Experiment No. Three.—An experimental apparatus was next constructed simulating on a small scale the ventilating system of a submarine. A full-sized standard submarine duct was not used, because none was available, and because it was felt that the explosions expected would break the apparatus, leaving it unavailable for further experiments. A diagram of the apparatus used is shown in Fig. 1. The apparatus consisted of alternate sections of lead and hard-rubber pipe with fan and flapper valve at opposite ends. Suitable connections for connecting the ground current (110 volts D.C.) along the length of the composite duct, as well as a lead for introducing the explosive mixture, were attached. Moisture was simulated by spraying electrolyte from an ordinary medical atomizer into the duct with the fan running. This was continued until it was observed that the inner surfaces were well coated. Tests were then undertaken as follows:

(a) Duct dry, ground electrodes disconnected, flapper valve open, fan running. Explosive mixture introduced—no explosion resulted.

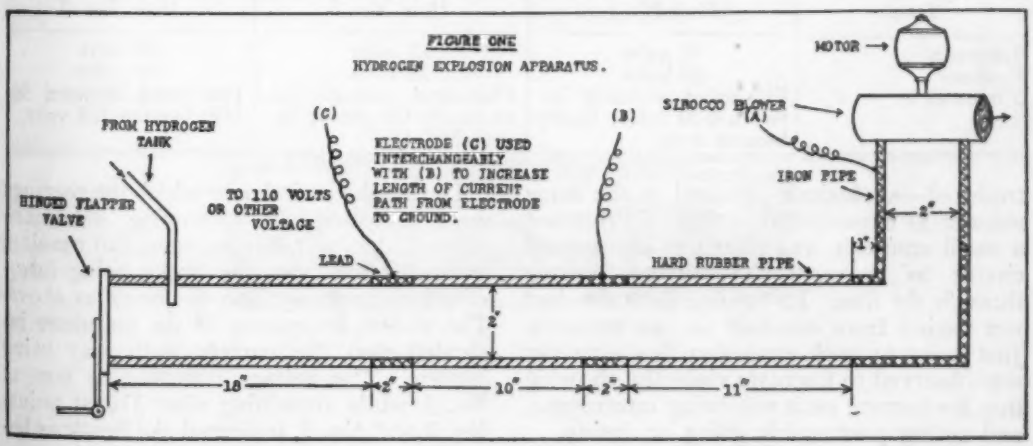
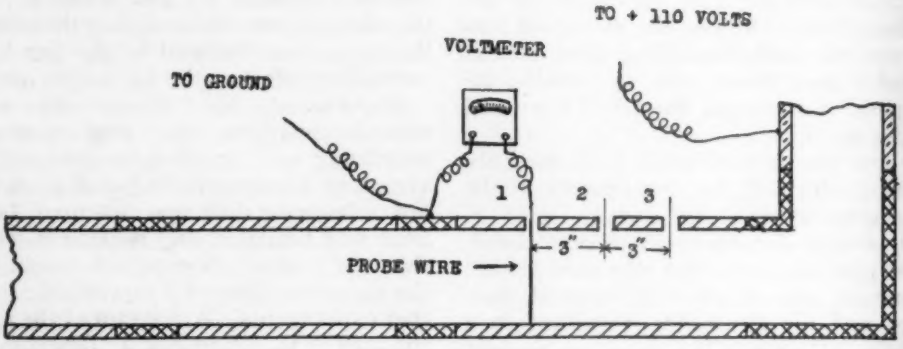


FIGURE TWO.

APPARATUS OF FIGURE ONE WITH HOLES FOR PROBE WIRE.



(b) Duct dry, ground connected to 110 volts D.C., flapper valve open, fan running. Explosive mixture introduced—no explosion resulted.

(c) Duct wet with electrolyte, flapper closed, ground connected, fan stopped. Explosive mixture introduced—fan was then quickly started, at the same instant opening the flapper—explosions resulted in almost every trial.

(d) Duct wet with electrolyte, flapper closed, fan stopped. Explosive mixture introduced—explosions obtained in the same manner as experienced in (c). In this test a small ammeter was placed in the ground circuit to measure the current flowing through the film. Its reading with the duct wet varied from one-half to two amperes. Just prior to each explosion this ammeter was observed to fluctuate violently, showing that the current path was being interrupted, and arcing presumably going on inside.

Experiment No. Four.—It was next desired to measure the difference of potential at different points along the duct and between the different sections of lead and hard-rubber piping. This was done by boring several small holes in the top of the hard-rubber pipe, to permit the introduction of a wire probe of a voltmeter. The other probe of the voltmeter was connected to a section made of lead pipe. A sketch of this arrangement is shown in Fig. 2. The following readings were obtained:

VOLTMETER READINGS WITH PROBE IN

Time	Hole No. 1	Hole No. 2	Hole No. 3
0 minutes	30 volts	75 volts	90 volts
1 minute	30 volts	75 volts	90 volts
5 minutes	Fluctuated violently between 0-30 volts; finally became zero.	Fluctuated violently between 75-110 volts; approached 110.	Fluctuated between 90-110; became 110 volts.

During the period over which the readings were collected the following conditions existed: duct wet, flapper open, fan running, ground current on, the probe being introduced successively into the holes as above. The violent fluctuation of the voltmeter indicated that the current path was being broken. The voltage dropping to zero at No. 1 while remaining near 110 at points No. 2 and No. 3, indicated the break as be-

ing between holes No. 1 and No. 2.

The above experiment was repeated with the duct dry but no voltmeter readings were obtained, showing conclusively that the acid film was the current carrier in the previous test.

Experiment No. Five.—In an effort to determine a ground voltage below which no explosions were obtainable, experiments were conducted progressively reducing the voltage across the electrodes shown in Fig. 1. It was appreciated that it was the current through the acid film which directly caused the arcing; however, it was assumed that the potential across the electrodes could be used as an index of this current. Keeping this in mind, experiments were proceeded with, and the following results obtained:

Voltage	*Explosions Obtained*
110	Consistent
90	Intermittent
70	Intermittent
60	Occasional
50 and below	None

This would then indicate that between fifty and sixty volts is the control voltage desired. In considering these results, however, due regard should be paid to the fact that, with the experimental apparatus, it could not always be assured that an explosive mixture of hydrogen was present in the tube. This was due to wind conditions, and also to the fact that after several explosions leaks developed in the apparatus. However the results obtained form a basis for the hypothesis that a considerable reduction in the battery ground voltage aboard submarines would have a direct effect on the explosion hazard caused by arcing in the ducts.

Summary.—From the experiments undertaken it is felt that the following facts are established:

(a) That the acid film on the interior of battery ventilation ducts is a conductor of electric current.

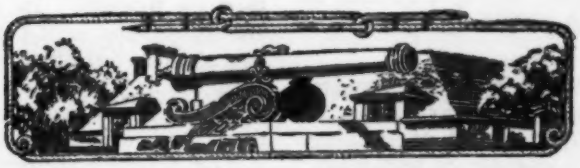
(b) That arcing takes place in the duct shortly after the supply of moisture is stopped.

(c) That this arcing will ignite an explosive mixture if it is present.

(d) That the starting or stopping of a blower does not appear to exercise any control over the explosion except that on board a submarine the stoppage of a fan would stop the supply of moisture, thus giving the acid film an opportunity to evaporate, leading up to the condition under (b).

The foregoing experiments conducted at Bellevue seem to be a proof of the assumption that there is only one source of the spark that causes the explosion. The "Ripple Theory" as originally advanced should now be reworded. A careful investigation of the resistance of electrolyte shows that at normal battery specific gravity the resistance is low. Hence, a high I^2R loss will result in a section having a thin film. The heat at such a section would be sufficient to drive off vapor and sulphurous fumes so that this section would tend to approach the physical properties of an insulator. Thus a gap would occur at this point in the film path with its resulting spark.

Since the design of a lead-acid battery does not permit the possibility of eliminating gassing, it seems to follow that the logical step in the prevention of battery explosions should be toward the elimination of the film path with the result that the spark would then be eliminated.



Officer Education *at* Home *and* Abroad

By LIEUTENANT LEO J. MCGOWAN, *U. S. Navy*

IN MAKING a study of education and training of officers of the navies of England, Japan, France, Germany, and Italy and comparing their scope, methods, and requirements to ours, we find many points of difference as well as similarity.

All five of the countries included in the study maintain an institution for the training of officers corresponding to our Naval Academy. In all of these five institutions the entrance requirements seem to be based upon the educational system of the country. The widest variation from this is in England, where they take the Dartmouth entry at the age of twelve and one-half years. In the years following his entry the Dartmouth cadet is given practically the same education that he would receive in a public school. When he reaches the age of our entry he is joined by graduates of the public schools and given a course similar to that of our Naval Academy.

Practically every country except ours holds a nation-wide competitive examination followed by a personal interview before a board. Our entrance requirements are manifestly easier than those of the other countries studied. This is due to:

(a) Our requirements are based on what the youths of the nation are expected to know.

(b) There is no class of supereducated youths upon whom we could draw.

(c) Our system of appointments is such that stricter requirements might operate to exclude youths from certain sections of the country.

Naturally, our easier entrance requirements are reflected in our heavy losses of midshipmen during the period of training. This may be said to operate in two ways: (a) Lax requirements admit some inferior material; and (b) the probationary period is extended throughout the entire period of the midshipman's training.

There is a feeling in other navies that once the cadet or midshipman is admitted into the service he has passed the hardest test of his career. No country except Italy comes anywhere near our loss of 43 per cent. England and Japan have losses of from 1 to 5 per cent and these are caused mostly by physical examinations.

The general opinion of those who have gone through our Academy and observed the foreign schools seems to be that greater emphasis is placed on instruction and practical demonstration at the latter. They seem to find that a greater effort is made to stimulate interest with little or no attention to an immediate mark or desire to find out just how much the student knows.

Naturally, at all such institutions there must be some urge in addition to the personal pride involved. This is usually expressed in terms of hope of reward or fear of punishment. The constant "bogey" of "bilging" is the greatest urge at our school, in addition to the hope of obtaining a high class standing. Unfortunately, the latter is not given universal attention and except with a few is seldom thought of. "Bilging" in the foreign schools has not the finality it has in ours. They all have a limit of endurance but they use a system similar to our civilian colleges and universities. England rewards success with something more tangible in the way of reduced time spent in the junior grades. They may reduce the time as a sublieutenant from thirty-six to thirteen months. In Italy the final class standing is not kept permanently, as it is in our service, but officers are returned to the academy as junior lieutenants and given an opportunity to improve their standing by their work in a general line course.

The primary training—that is, midshipman and cadet training—which in some countries extends through the ensign grade, is in all cases broader than ours. France, alone, has a two-year academy course but

the entrance examination would require the knowledge of our second classmen. After graduation they send the ensigns to two schools, one of application and one of improvement, so their course may be considered as broad as ours.

Their secondary training, that is, their officer education and training in all cases except in Germany, covers as much ground as ours and seems to be more universal and mandatory. At the present time none of our officers is required to take any course, although if the plans of the Knox-King-Pye board are carried out all officers will have four periods of instruction. Following this plan our secondary education will be equal to that in any of the countries studied and will be better than in most of them.

With the consideration of secondary education comes the question of specialization. There are two general types of specializing, corps and line specializing. There is a very prevalent tendency in foreign navies to form a corps at the slightest provocation, England being the exception to the rule. There is much specializing by the corps method that seems superfluous. They all have an engineering corps and it is safe to say that there is not a satisfied engineer corps in the world. This surely justifies our method in that respect.

There is much line specializing in all navies. England does this to quite an extent. After becoming lieutenants, officers almost invariably specialize, although they are not required to. They may specialize in gunnery, navigation, torpedoes, radio, signals, or physical and recreational training. This means that their duties until reaching the commander grade are restricted to their specialty. A lieutenant qualified in gunnery is thereafter known as a lieutenant (g), qualified in torpedoes as a lieutenant (t), etc. A specialist is considered to have the better chance for selection to the rank of commander. They carry this specializing so far that nonspecialist turret officers are often senior to the specialist gunnery officer. All countries follow this method to some extent. Japan awards "brevets" to officers qualified in various branches.

It could be said that we are tending towards the same method. We have been sending officers on the average of a hundred a year, since the war, to take up some special course. This gives us roughly a thousand officers whose duties are restricted until the commander grade. This is exclusive of five hundred officers in aviation. While the British system is not recognized officially we are following it on a smaller scale. It has been brought about more by the need of increased knowledge along material lines than by a deliberate copying of the British method. There is a tendency both of the Bureau of Navigation and of the officers concerned to limit the time in the specialty to a minimum. The British system tends to have officers in the various positions who know their jobs, but it is not giving them the well-rounded experience that our method gives our officers.

Some navies attempt to give all officers of the line and corps the same background, as nearly as possible. Every officer in the navy in Italy spends some time at the naval academy. This seems to be a general policy in other European countries insofar as possible. There is also a tendency to have a paymaster's school paralleling the naval academy.

The equipment of our Naval Academy is considered superior to any in the world. The facilities of our officers' schools are not, as a rule, as extensive, but considering the use that we make of civilian institutions, we are at least equal.

The system in England is indicative of lack of faith in the methods used and a tendency to experiment with many methods. That of France shows the lack of an orderly program with a scattering of schools throughout the country. Many of their schools are without meaning or justifiable existence. Italy has a very definite program and is doing much to educate its officers. In order that all may gain necessary sea experience, they send squads of officers on the subsidized merchant-marine ships for short periods. The Japanese seem to have patterned their schools upon what they consider the best that the other powers offer. Their schools are numerous and include all fields of naval endeavor. They have carried theoretical naval education farther than any other nation and it would seem to be at the expense of the practical. They have more officers under instruction than any other nation in the world.

While our system may have its weaknesses it seems fundamentally sound, and should produce well-educated officers.

The Governors *of the* United States Naval Home, Philadelphia

By GEORGE H. ECKHARDT

A TABLET recently placed in the chapel of the United States Naval Home, in Philadelphia, bears mute evidence of the long line of officers of high rank who have served as governors of the institution. Beginning with Commodore James Biddle, back in 1838, the list comes down through men who have served the nation well both as naval men and as men who contributed greatly towards winning for the United States a place among the powers of the world. As the list of names inscribed on the tablet is scanned one is forcibly reminded of the fact that the men of the Navy have not only made up a fighting force, but also a force for peace, in that they have handled —and handled well—many delicate foreign missions. From Commodore Biddle, down to Rear Admiral Gleaves, the last name on the list, space being reserved for others, all have played a part in international affairs.

Few plans have carried out as well as the original thought that the governor of the Home should be an officer of high rank, "who, with the title of Governor, might, while he gave dignity to the station, sustain no diminution of his own," as Secretary Paulding so aptly put it in his letter to Commodore Biddle in 1838, offering the position to that esteemed officer. Commodore Biddle accepted the post, and was appointed the first governor, on August 1, 1838, and the station was removed from the jurisdiction of the commandant of the navy yard and made a separate and independent command. The early history of the Home had not been as pleasant as might have been desired, but with the appointment of Commodore Biddle matters soon looked much brighter.

The corner stone of the present building was laid on April 3, 1827, Commodore Bainbridge, at that time president of the Navy Board, delivering the principal address, outlining the fundamental purposes of the Home, purposes that have grown into traditions honored and respected by the governors who have administered it. He said:

> The expense of the building which is about to commence under circumstances so auspicious is defrayed out of a fund raised by the monthly contributions of the officers, seamen, and marines in the national service. These contributions commenced in the year 1796, and, of course, nearly contemporaneously with the origin of our naval establishment. By the fostering care of our government, the fund so raised has accumulated to a sum exceeding $200,000. This joint stock is now to be appropriated, under the direction of the government, to the purposes for which it was originally intended. A home will thus be established for the faithful tar who has been either worn out or maimed in fighting the battles of his country. A comfortable harbor will be secured, where he may safely moor and ride out the ebb of life, free from the cares and storms by which he has been previously surrounded. He will here cheerfully and proudly live with his own messmates, with the companions of his former sports, toils and dangers, and where they will animate each other, by recounting the pleasures which they enjoyed, the perils which they escaped, and the battles which they fought. A picture of happiness will thus be exhibited, not less gratifying to the patriot than it will be useful, and stimulating the intrepid youth of our country to enlist under the naval banner that they may also secure similar honors and comforts for a green old age.

The purposes of the Home—the original name of Asylum was changed to the better sounding name of Home, July 1, 1889—are best expressed in these words of Commodore Bainbridge as he laid the corner stone: and the post of governor is best comprehended in the very words used by Secretary Paulding in offering that post to Commodore Biddle.

Born in Philadelphia in 1783, James Biddle, with his previous brilliant record both for war service and general attainments—for it will be remembered that it was he who took formal possession of Oregon in 1817—

brought great prestige and importance to the post as the first governor. Commodore Biddle was the first naval officer to propose a school for midshipmen. After some correspondence, and since no congressional appropriation for the establishment of an academy was forthcoming at the time, eleven midshipmen were ordered to the Home for instruction in November, 1839. This marked the very beginning of our naval school. Lieutenant, afterwards Admiral, Foote, who was then executive officer of the post, interested himself in providing better living conditions for the midshipmen, who were much older than those forming the cadet corps at Annapolis. The building was then housing three distinct institutions; the Home, for which it was originally designed; the general naval hospital for the station; and the naval school. Naturally quite a bit of friction arose.

In 1842 Commodore Biddle was relieved by Commodore James Barron, that unfortunate figure in our naval history. Because of the friction arising from the housing of three distinct institutions under one roof, Barron asked to be relieved in November of the same year, despite the fact that the pensioners addressed a letter to him requesting that he reconsider his decision.

Lieutenant Andrew Hull Foote was left in charge after the departure of Commodore Barron. He was only thirty-six at this time, and much of his brilliant career was yet before him. A devout Christian and temperance worker, he induced many to sign the temperance pledge and it was at the Home that Foote began his crusade against liquor that had much to do with the final abolition of the grog ration in the Navy.

Commander William Wister McKean was ordered to the Home in February, 1843, Lieutenant Foote remaining. Commander McKean was followed in May, 1844, by Commodore Charles W. Morgan, the Navy Department having decided to put a post captain in command. In 1845 Commodore Morgan received orders to send the furniture and apparatus of the naval school to Annapolis, where the midshipmen under instruction were ordered to assemble. The present Naval Academy was thus definitely established.

Commodore Jacob Jones, an officer of great distinction in the War of 1812, followed Commodore Morgan, and he, in turn, was relieved after three years by Commodore George Campbell Read, who left this post to assume command of the Navy Yard at Philadelphia. To H. A. Adams, who followed as commander in charge, belongs the distinction of having been the first governor of the Home to have graduated from Annapolis, but he was soon followed by Commodore Geisenger, who remained for nearly three years.

It was in April, 1849, that the Home was taken from the cognizance of the Bureau of Medicine and Surgery and placed under the jurisdiction of the Bureau of Yards and Docks. Later, in 1898, it was placed under the supervision and control of the Bureau of Navigation.

At one time a part of the grounds was used for burial purposes and it is of more than passing interest to note that the remains of Commodore Porter, of *Essex* fame, rested there for a year after having been brought from Constantinople, where he died. All bodies were later removed from the grounds.

Commodore George W. Storer followed Commodore Geisenger, and he in turn was followed by William Wister McKean, who returned as governor with the rank of captain. It was about this time that the first appropriation was made for the Home directly from the Treasury, instead of from the hospital fund as heretofore.

Commodore William Carmichael Nicholson then became governor during the exciting days preceding and during the opening months of the Civil War. So great was the ardor of the old men to reënter the service that a circular was issued announcing that when a beneficiary shipped he forfeited all the privileges of the Home. In August, 1862, Rear Admiral George Campbell Read died at the Home, and he was succeeded by Commodore Frederick Engle, who, at the outbreak of the Civil War, had been despatched to China to bring home the *Hartford*. The buildings were horribly crowded with the sick and wounded of the war.

Commodore Engle was followed by Rear Admiral Hiram Paulding, who had fired the Navy Yard at Norfolk, and who was the last of the governors to have served in the African difficulties, thus marking the passing of an era among the governors. Then came Rear Admiral James L. Lardner, who was on the *Brandywine* when Lafayette re-

turned to France in 1825. He in turn was followed by Rear Admiral Melanchton Smith.

Then came Commodore George Beall Balch, who had himself studied at the Naval School when it was located at the Home. Commodore Balch was followed by Rear Admiral James Robert Madison Mullany, of Civil War fame.

In October, 1879, Rear Admiral Donald MacNeill Fairfax, of the famous Fairfax family of Virginia, became governor. It was Rear Admiral Fairfax who, as a lieutenant, in November, 1861, removed the Confederate Commissioners Mason and Slidell from the *Trent* to the *San Jacinto*. In October, 1881, he was relieved by Vice Admiral Stephen Clegg Rowan, who, a year later, was relieved by Captain Oscar Fitzalan Stanton.

Then followed a long list of officers of high rank, each of whom held the post for periods up to three or four years, Rear Admiral Henry Thomas Mayo, who demanded the Mexican apology at Tampico in April, 1914, being one of the outstanding later governors. Rear Admiral Albert Gleaves is the present governor of the Home, and it has been through his efforts that the tablet was erected to the men who had preceded him in his honorable post.

Medical Director Edward Shippen, U. S. Navy, published an able account of the history of the Home in the Pennsylvania *Magazine of History and Biography*, under the title, "Some Account of the Origin of the Naval Asylum at Philadelphia." This was in 1877.

GOVERNORS OF THE NAVAL HOME

(From *Regulations of the United States Naval Home, Philadelphia.*) 1929 Edition.

Cornerstone laid 1827; building suspended 1829–1832; completed 1833

Names	Rank	From—	To—
James B. Cooper	Lieutenant (superintendent)	May 31, 1834	Aug. 1, 1838
James Biddle	Commodore (governor)	Aug. 1, 1838	Apr. 11, 1842
James Barron	Commodore	Apr. 11, 1842	Nov. 30, 1842
A. H. Foote	Lieutenant in charge	Nov. 30, 1842	Feb. 23, 1843
W. W. McKean	Commander	Feb. 23, 1843	May 15, 1844
Charles W. Morgan	Commodore	May 15, 1844	July 1, 1847
Jacob Jones	do	July 1, 1847	June 17, 1850
George C. Read	do	June 18, 1850	Aug. 8, 1850
H. A. Adams	Commander in charge	Aug. 8, 1850	May 1, 1851
David Geisenger	Commodore	May 1, 1851	July 6, 1854
George W. Storer	do	July 6, 1854	Sept. 1, 1857
W. W. McKean	Captain	Sept. 1, 1857	May 1, 1860
W. C. Nicholson	Commodore	May 1, 1860	May 18, 1861
George C. Read[1]	Rear admiral	May 18, 1861	Aug. 22, 1862
Frederick Engle	Commodore	Sept. 6, 1862	May 1, 1866
Hiram Paulding	Rear admiral	May 1, 1866	June 28, 1869
James L. Lardner	do	June 28, 1869	June 3, 1872
Melancthon Smith	do	June 3, 1872	Apr. 1, 1873
George B. Balch	Commodore	Apr. 1, 1873	Mar. 1, 1876
J. R. M. Mullany	Rear admiral	Mar. 1, 1876	Oct. 26, 1879
D. M. Fairfax	Commodore and rear admiral	Oct. 27, 1879	Sept. 30, 1881
S. C. Rowan	Vice admiral	Oct. 8, 1881	June 30, 1882
O. F. Stanton	Captain	July 1, 1882	Mar. 9, 1883
A. C. Rhind	Commodore and rear admiral	Mar. 10, 1883	Oct. 30, 1883
F. A. Roe	do	Oct. 30, 1883	Oct. 4, 1885
Bancroft Gherardi	Commodore	Oct. 6, 1885	Oct. 14, 1886
Joseph S. Skerrett	Captain	Oct. 14, 1886	May 31, 1888
E. E. Potter	do	May 31, 1888	Mar. 31, 1891
Henry Erben	do	Mar. 31, 1891	May 19, 1891
O. F. Stanton	Commodore	July 1, 1891	July 31, 1893
E. E. Potter	Captain and commodore	July 31, 1893	May 9, 1895
J. C. Watson	do	May 9, 1895	Apr. 30, 1898
J. H. Sands	Captain	Aug. 30, 1898	Sept. 17, 1901
C. E. Clark	Rear admiral	Sept. 17, 1901	July 1, 1904
Nicoll Ludlow	do	Oct. 3, 1904	Dec. 2, 1907
James M. Miller	do	Dec. 2, 1907	Nov. 11, 1908
N. E. Niles	do	Nov. 17, 1908	Apr. 1, 1910
U. R. Harris	do	Apr. 1, 1910	Sept. 14, 1911
Alfred Reynolds	do	Sept. 14, 1911	Mar. 25, 1912
Albert Mertz	do	Mar. 25, 1912	May 20, 1913
J. H. Hetherington	Commander	May 20, 1913	Sept. 16, 1917
T. D. Griffin	Commodore	Oct. 11, 1917	Jan. 20, 1920
L. A. Kaiser	Captain	Jan. 20, 1920	Aug. 20, 1922
J. S. Graham	Commander	Aug. 20, 1922	July 14, 1924
Henry T. Mayo	Rear admiral	Aug. 11, 1924	Aug. 1, 1928
Albert Gleaves	do	Sept. 1, 1928	.....

[1] Died August 22, 1862, leaving Commander Peter Turner in charge

GOVERNORS
OF THE
UNITED STATES NAVAL HOME
1827 PHILADELPHIA PENNSYLVANIA 1833
SINCE ITS ESTABLISHMENT IN 1827
BUILDING SUSPENDED 1829-32
NAME RANK FROM TO
JAMES B COOPER LIEUTENANT SUPERINTENDENT MAY 23 1834 AUG 1 1838
JAMES BIDDLE COMMODORE AUG 1 1838 APR 11 1842
JAMES BARRON COMMODORE APR 11 1842 NOV 30 1842
A H FOOTE LIEUTENANT IN CHARGE NOV 30 1842 FEB 23 1843
W W M°KEAN COMMANDER FEB 23 1843 MAY 15 1844
CHARLES W MORGAN COMMODORE MAY 15 1844 JULY 1 1847
JACOB JONES COMMODORE JULY 1 1847 JUNE 17 1850
GEORGE C READ COMMODORE JUNE 18 1850 AUG 8 1850
H A ADAMS COMMANDER IN CHARGE AUG 8 1850 MAY 1 1851
DAVID GEISENGER COMMODORE MAY 1 1851 JULY 6 1854
GEORGE W STORER COMMODORE JULY 6 1854 SEPT 1 1857
W W M°KEAN CAPTAIN SEPT 1 1857 MAY 1 1860
W C NICHOLSON COMMODORE MAY 1 1860 MAY 18 1861
GEORGE C READ REAR ADMIRAL MAY 18 1861 AUG 22 1862
FREDERICK ENGLE COMMODORE SEPT 6 1862 MAY 1 1866
HIRAM PAULDING REAR ADMIRAL MAY 1 1866 JUNE 28 1869
JAMES L LARDNER REAR ADMIRAL JUNE 28 1869 JUNE 3 1872
MELANCTHON SMITH REAR ADMIRAL JUNE 3 1872 APRIL 1 1873
GEORGE B BALCH COMMODORE APRIL 1 1873 MAR 1 1876
J R M'MULLANY REAR ADMIRAL MAR 1 1876 OCT 26 1879
D M FAIRFAX COMMODORE & REAR ADMIRAL OCT 27 1879 SEPT 30 1881
S C ROWAN VICE ADMIRAL OCT 8 1881 JUNE 30 1882
O F STANTON CAPTAIN JULY 1 1882 MAR 9 1883
A C RHIND COMMODORE & REAR ADMIRAL MAR 10 1883 OCT 30 1883
F A ROE COMMODORE & REAR ADMIRAL OCT 30 1883 OCT 4 1885
BANCROFT GHERARDI COMMODORE OCT 6 1885 OCT 14 1886
JOSEPH S KERRETT CAPTAIN OCT 14 1886 MAY 31 1888
E E POTTER CAPTAIN MAY 31 1888 MAR 31 1891
HENRY ERBEN CAPTAIN MAR 31 1891 MAY 19 1891
O F STANTON COMMODORE JULY 1 1891 JULY 31 1893
E E POTTER CAPTAIN & COMMODORE JULY 31 1893 MAY 9 1895
J C WATSON CAPTAIN & COMMODORE MAY 9 1895 APRIL 30 1898
J H SANDS CAPTAIN AUG 30 1898 SEPT 17 1901
C E CLARK REAR ADMIRAL SEPT 17 1901 JULY 4 1904
NICOLL LUDLOW REAR ADMIRAL OCT 3 1904 DEC 2 1907
JAMES M MILLER REAR ADMIRAL DEC 2 1907 NOV 11 1908
N E NILES REAR ADMIRAL NOV 17 1908 APRIL 1 1910
U R HARRIS REAR ADMIRAL APRIL 1 1910 SEPT 14 1911
ALFRED REYNOLDS REAR ADMIRAL SEPT 14 1911 MAR 25 1912
ALBERT MERTZ REAR ADMIRAL MAR 23 1912 MAY 20 1913
J H HETHERINGTON COMMANDER MAY 20 1913 SEPT 16 1917
T D GRIFFIN COMMODORE, RETIRED OCT 11 1917 JAN 20 1920
L A KAISER CAPTAIN JAN 20 1920 AUG 20 1922
J S GRAHAM COMMANDER AUG 20 1922 JULY 14 1924
H T MAYO REAR ADMIRAL, RETIRED AUG 11 1924 AUG 1 1928
ALBERT GLEAVES REAR ADMIRAL SEPT 1 1928

Courtesy George H. Eckhardt

TABLET IN CHAPEL OF THE U. S. NAVAL HOME, PHILADELPHIA

Courtesy George H. Eckhardt

THE BELL OF THE U.S.S. *PHILADELPHIA* MOUNTED AT THE GATE OF THE U. S. NAVAL HOME, PHILADELPHIA

Courtesy George H. Eckhardt

FIGUREHEAD OF FRIGATE *FRANKLIN*, 1815

This figurehead was sent to the U. S. Naval Home, Philadelphia, by the Naval Academy.

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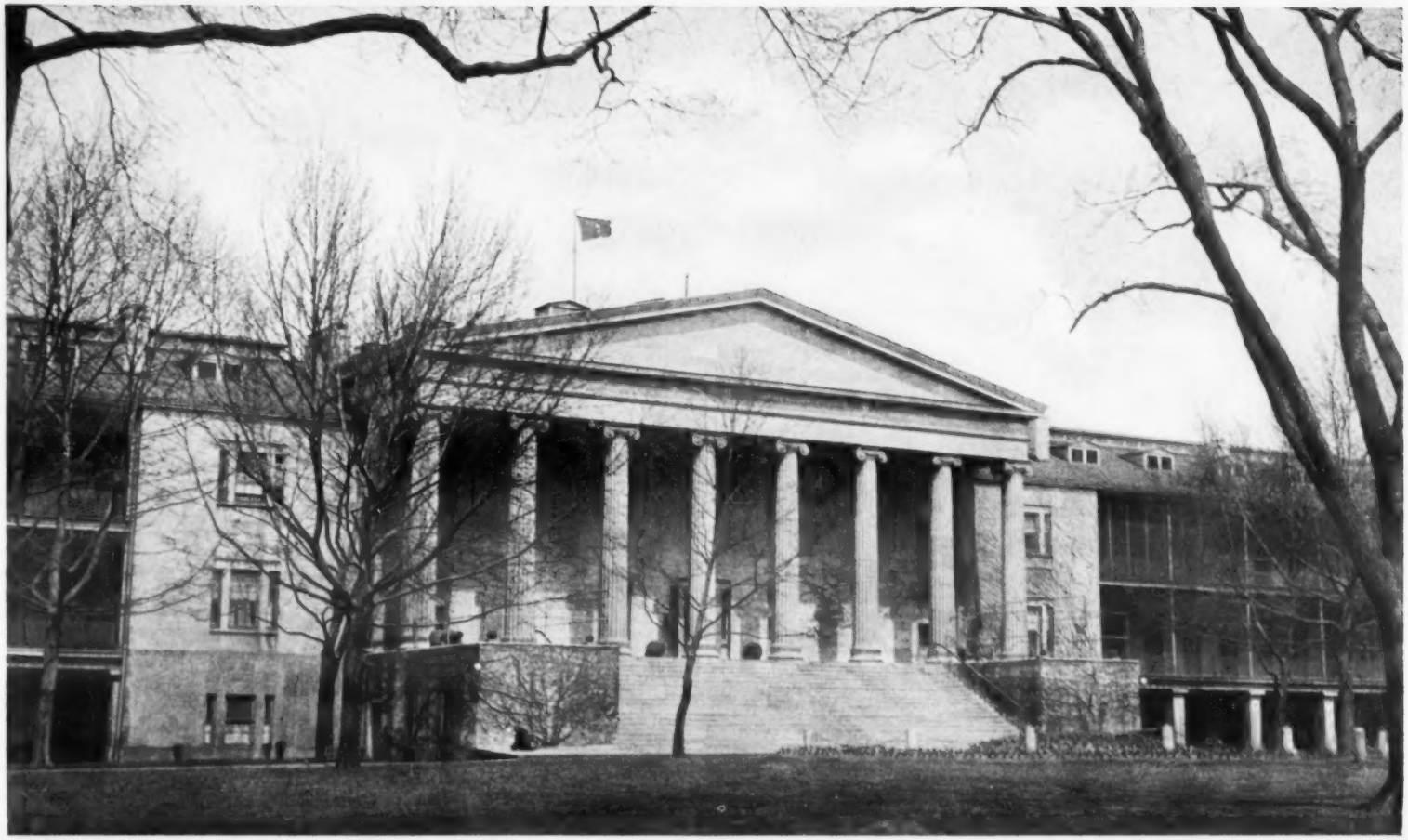

Courtesy George H. Eckhardt

GENERAL VIEW OF THE U. S. NAVAL HOME, PHILADELPHIA

This view shows the spaciousness of the Home, and the beauty of the grounds. The first United States Naval Academy was located in this building.

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Courtesy George H. Eckhardt

GENERAL VIEW OF FRONT OF THE U. S. NAVAL HOME, PHILADELPHIA

The two-starred flag of Rear Admiral Gleaves, the present Governor, can be seen flying from the staff.

Courtesy Navy Department, Washington, D.C.

U.S.S. *SALT LAKE CITY*, SISTER-SHIP TO THE *PENSACOLA*

These two ships mount ten 8-inch guns each in four turrets, 3-gun turrets being superposed on 2-gun turrets, both forward and aft.

Courtesy Navy Department, Washington, D.C.

U.S.S. *SALT LAKE CITY*, SISTER-SHIP TO THE *PENSACOLA*

These two ships mount ten 8-inch guns each in four turrets, 3-gun turrets being superposed on 2-gun turrets, both forward and aft.

Courtesy Bethlehem Shipbuilding Corp., Ltd.

U.S.S. *NORTHAMPTON*

Her sister-ships are the *Chester, Augusta, Chicago, Louisville,* and *Houston.* These ships mount nine 8-inch guns in three triple turrets, two forward and one aft. Note the difference from the *Salt Lake City.*

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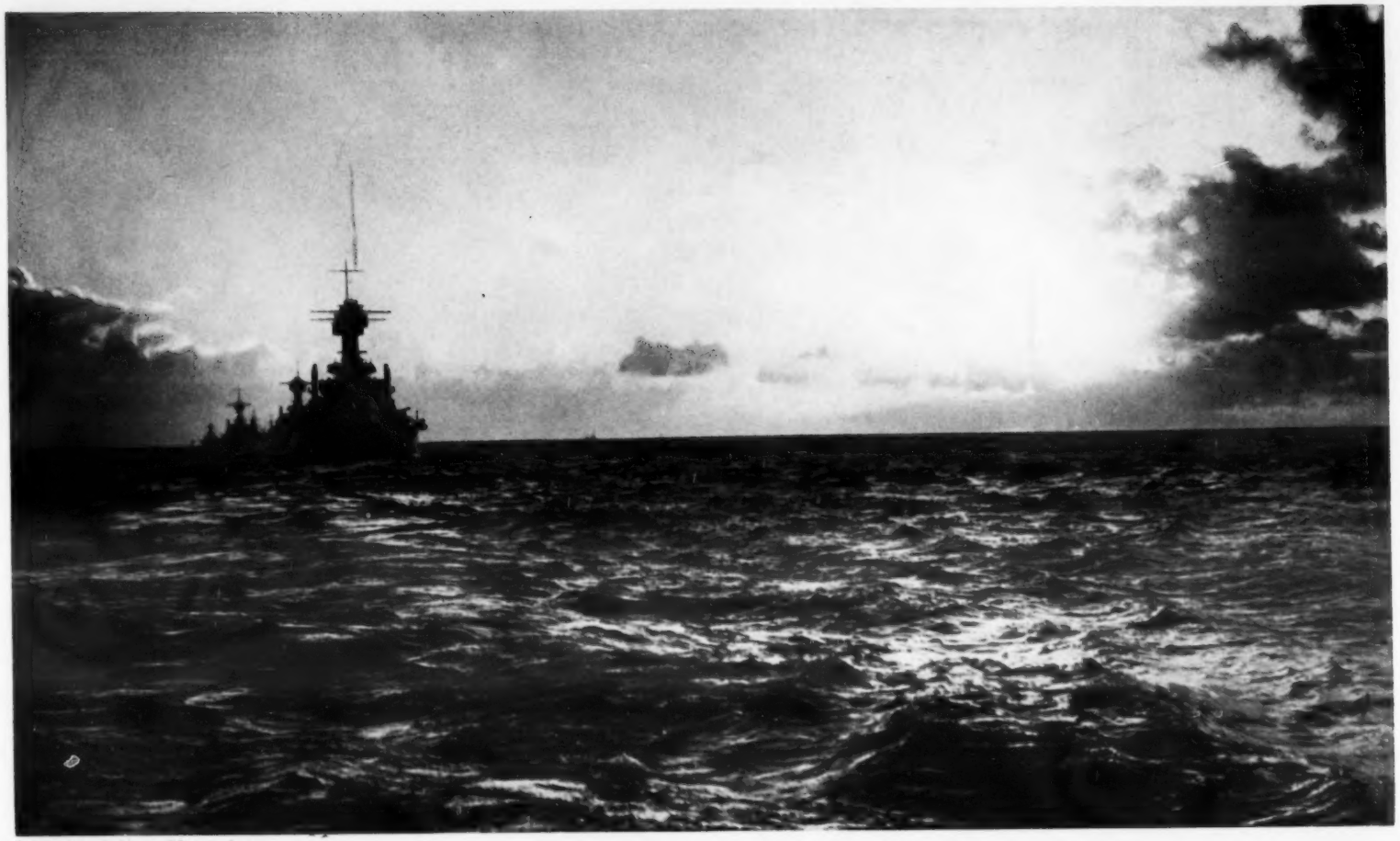
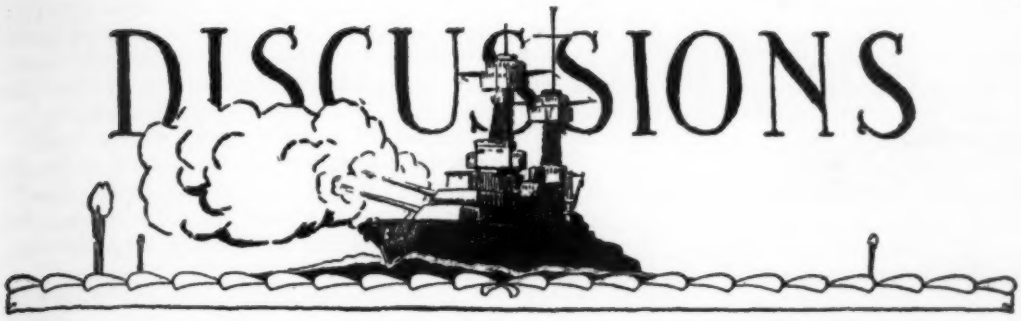


International News Photos, Inc.

A SINGLE-FILE MARCH ACROSS THE OCEAN

A striking photograph of a part of the Battle Fleet as it appeared off Guantanamo Bay at sunset.

DISCUSSIONS



A SINGLE-FILE MARCH ACROSS THE OCEAN
A striking photograph of a part of the Battle Fleet as it appeared off Guantanamo Bay at sunset.

The Battle at Blanc Mont

(See PROCEEDINGS for January, 1930, p. 1; February, p. 89; March, p. 177; and April, p. 304.)

CAPTAIN TREVOR W. SWETT, *Infantry, D.O.L.*, Second Division, Historical Section, Army War College.—Colonel Otto, in "The Battle at Blanc Mont" has accomplished the difficult task of recording the history of an involved operation so as to present both the special problems and the broad view of events at division and higher headquarters, and the give and take, successes and failures, and surge of combat in the lower echelons. All are essentials, and together make up something approaching a complete picture.

The author's German sources, largely hitherto unpublished material from unit war diaries, give information of high value. For one thing, they show in actual performance the flexibility of the German system of command with its nice balance between control by superior headquarters and responsibility of local commanders, and we see staffs and commanders, under pressure and in grave emergencies, with relatively smoothly working troop units. The sources emphasize again the efficiency of the German arms in the last engagements of the war.

Any number of incidents stand out in these records of regiments and battalions. To mention several: the German refusal to accept the loss of Essen Hook on the slopes of Notre Dame des Champs (Helenen Hill) and the infiltration back into it to plague the French 21st Division and the Marines; the St. Etienne fighting, with its stubborn see-saw of attacks and counterattacks for four days; the handful of worn-out troops on Blanc Mont desperately maintained against odds that must surely overwhelm them; the usually correct analyses of the American-French intentions as the German commanders evaluated successive American attacks; the clean-cut breaking away from action "according to plan." Without such records it is impossible fully to appreciate the severity of the battle and its course.

Unfortunately the American sources used by Colonel Otto are not entirely adequate. The Battle Monuments Commission studies are intended to give only the framework of the various American engagements, and to fix the front lines with certainty. The Historical Branch monograph "Blanc Mont" (Monograph No. 9) has many omissions and inaccuracies, in part because it was written before full information had been systematically collated. Neither the Battle Monuments Commission study nor Monograph No. 9 parallels Colonel Otto's work in purpose or source material, and certainly neither gives so live an account.

Several incorrect statements are noted, since Colonel Otto uses them as authority. According to the Battle Monuments Commission study the French 21st Division operated under the French 21st Corps on October 3; this division was, however, under the French 11th Corps throughout the engagement. Operation orders 22 and 24 (11th Corps, General Prax) prescribed a passage of lines by the 22d Division, relieving the 21st Division in the front line, the 22d thereupon to advance northwest on October 4. Monograph No. 9 places the 22d Division near the St. Pierre-St. Etienne road at 10:00 A.M., October 4, with other French troops near the Arnes northwest of St. Pierre. Colonel Otto rightly questions this. The message on which the questioned paragraph is based was in fact

dated October 3, at 10:45 A.M., and dispatched at that time from the 22d Division by carrier pigeon. Monograph No. 9 wrongly assumes that the 5th Marines' advance from Blanc Mont to the northeast, prescribed by Division in Field Order 36, took place as intended on October 3; the situation for midnight, October 3-4 as given in the monograph is therefore seriously in error. This error unaccountably originated in the operations report of the 4th Brigade, but 4th Brigade messages and 5th Marine reports correctly establish the date and time of the movement. The advance was made in the early morning of October 4. The 2d and 3d Battalions, 5th Marines, attacked north in column at 6:00 A.M.; the 1st Battalion, following the 3d Battalion, hastily changed its direction to meet a German attack and, pivoting on its left, itself attacked towards the northwest. All the battalions had terrific casualties; the 1st Battalion lost over 70 per cent of its strength, and that evening mustered 12 officers and 156 men; one of its companies, the 66th, at the end of the day had 1 officer and 22 men. These were the morning assaults against Group Reiss. The error in date in the monograph explains the absence of any reference therein to the extremely heavy infantry combat recorded in detail by Major Reiss. Monograph No. 9 wrongly notes the 7th French Division on the left of the 2d Division on October 6; the 7th did not relieve the 22d Division until the night of October 7-8.

Through midnight, October 5-6, American-French and German times were the same. Germany reverted from summer time to standard Central European time on September 16. The Allied armies meanwhile continued to use daylight-saving time (identical with Central European) until 1:00 A.M., October 6. Only from October 6 on, therefore, does the difference of one hour between the American and German times apply.

Records of the 2d Division are being collected and edited. Most of the unit diaries, reports, and field messages have been assembled. In general, the American organization reports for Blanc Mont are far briefer than the German, having in most cases been submitted not as daily accounts but as reports for the entire period of the operations. While these reports cover the important phases of the fighting, they give by no means all the significant detail found in the German papers. Speaking of records, the order of the commander of the 102d German Infantry Brigade, quoted by Colonel Otto, with great wisdom emphasized the vast importance of combat records *contemporary with events*. Such an order should be enshrined in gold, and repeated thrice daily by all officers when battle is imminent.

The German High Command's estimate (September 29, 1918) of the American strength in France and on the Champagne-Argonne front:

> Numerous French and American reserves have been moved behind the front. . . . . Among the American reserves here we find that there are as yet only four divisions all of which have previously been on the front. . . . . The advent at the front of the ten additional American divisions, already suspected of being in France, but not yet in appearance, must be reckoned with.

is hardly a tribute to the German information service. *Prior* to September 26, sixteen American divisions had fought in active sectors, and eight had occupied quiet sectors: a total of twenty-four divisions with front-line experience.

Colonel Otto suggests that after July 20, when the significance of the failure of the July 15 offensive was appreciated, the German armies fought simply for endurable peace, not for final victory. This is an item of some interest, for August 8, "the Black Day," has, I believe, been more generally accepted as marking the real crisis when Germany's hopes crumbled. In any event, retreat was thereafter dictated by increasingly overpowering circumstances. The Gudrun Operation, gradually relinquishing the Hunding-Brunhild-Kriemhild lines, is one of the most obstinate withdrawals in military history. No orders were ever more faithfully or ably carried out than the September 30 withdrawal instructions of the Crown Prince's Army Group. Machine guns and light artillery dotted every *i* and crossed every *t* in them.

When General Lejeune assured General Gouraud that his 2d Division could break the Blanc Mont line, it seemed at least possible that this would be the last operation of the division, for there were rumors in high places of its dissolution.

A break-through in this area presented one of the most forbidding problems on the

Western Front. Blanc Mont was essential to the retention of Moronvilliers, both were vital to the German defense of the whole sweep of country between Rheims and the Argonne, and to protect the Mezières-Metz railway and the Metz-Thionville pivot the Argonne area must hold. Small wonder that the 3d German Army's chief of staff, after the October 3 assaults had established the Americans on Blanc Mont, spoke of "the most serious political nature" of the sector defense and the necessity of retaking Blanc Mont.

French divisions had shattered themselves to pieces in this Champagne desolation. Navarin Ferme was the forward element of a hitherto impregnable series of positions whose elaborately organized trench systems took uncanny advantage of natural features. The Blanc Mont foreground was particularly deadly, and abnormal losses in a frontal attack here were certain. General Lejeune's daring conception of a converging assault on the Blanc Mont—Médéah Ferme line, avoiding the Bois de la Vipère, the Altona position, and the southern slope of Pylone (Schlesier Hill), brought about the tremendous initial success on October 3, and in reality this first racing attack decided the battle. In the account of October 3, Colonel Otto does not sufficiently emphasize the importance of this plan, although commenting on it at greater length at the end of the study. His description leaves, too, the far from correct impression of a somewhat haphazard move of the 3d Brigade to the east and north to reach its jump-off line.

The commanders of the 3d and 4th Brigades received verbal orders for the October 3 attack at a conference with General Lejeune on the afternoon of October 2, shortly after Army and Corps had finally approved his plan of converging on the objective. Complete written orders were unavoidably delayed pending receipt of the Corps order, which reached 2d Division at 10:00 P.M. Translation of the order caused a further delay. A late change increased the artillery preparation time from five minutes to twenty minutes. The essential points to supplement the afternoon's verbal orders, namely the new time of *H* hour and the new length of the artillery program, were sent by Division to the brigades at the earliest possible moment:

> October 2, 1918. 8:45 P.M. Memorandum for Generals Ely and Neville.
>
> The Corps order changes the situation as explained to you, in the following particulars: The artillery preparation starts fifteen minutes earlier. The infantry attack starts forty minutes earlier.

This message, taken by a staff officer, reached 4th Brigade Headquarters shortly after midnight, and 3d Brigade Headquarters at 3:00 A.M. Division in this instance cannot be chided for the late issue of Field Order 35, though admittedly there was no opportunity for detailed orders based on the written division order to reach battalions.

Some explanation of the rôle of the 22d French Division should be made. Far from accomplishing little, it attacked persistently, to good purpose, and proved of great assistance to the Americans. The 11th Corps had prescribed that the 22d Division on October 4 advance to the northwest. This was carried through, and forced back the garrison of Notre Dame des Champs. Meanwhile the 2d Division was unsupported on its flanks, neither of the neighboring French divisions having kept pace with its rush. The northwest direction of the 11th Corps attack was intended to free the area west of Blanc Mont, but this maneuver was too slow to correct the critical position in which the left of the 4th Brigade found itself. By the afternoon of October 4 the 11th Corps operations had in no way relieved the situation. Late that evening, communicating direct with the 22d Division, and emphasizing his request by furnishing a map plotting the most recent front-line locations, the chief of staff of the 2d Division requested that the 22d Division protect the Marine left. Until this direct communication, the commander of the 22d Division had not had dependable information of the American line. He immediately undertook a rearrangement of his units, changed the prescribed northwest direction for his right regiment, and without reference to Corps ordered it to attack north on a two-battalion front, its third battalion following in reserve. The advance started at 6:00 A.M., October 5, line of departure the St. Pierre trench west of Blanc Mont; at nine o'clock the regiment reported that it was about half a kilometer south of St. Etienne.

While along most of the 22d Division front the German 14th Infantry Division

had withdrawn during the night to the Arnes, the German 149th Infantry Regiment remained on the west slope of Blanc Mont, and from a particularly venomous strong point blocked the advance of the French right and the Marine left. Eventually the 3d Battalion, 6th Marines, attacking at 6:15 A.M., October 5, after a powerful artillery bombardment, overran this strong point. Without the 22d Division's simultaneous advance north, the 2d Division flank would have remained open, and the clearing of this strong point would have been of local value only. Instead, the American-French line was pushed forward north of Blanc Mont to the St. Etienne area.

As Colonel Otto suspects, the early morning attack on October 6 by the 3d Battalion, 6th Marines, and the 2d Battalion, 23d Infantry, against Hill 160 (Blodnitz Hill) and the trenches east of St. Etienne was not simply the fortunate result of agreement between the regimental commanders concerned. Direct arrangement for the infantry assault appears to have been delegated to the regimental commanders, subject to approval by the respective brigade commanders. Artillery coördination with the infantry, under 2d Field Artillery Brigade procedure, was effected through the liaison officers with the infantry regiments, and had been developed to provide rapid preparations for extensive firing. In this instance all guns of the brigade were used, with fire for an hour on the enemy front line, machine-gun nests, rear areas, and communications, preceding a rolling barrage. Bitter experience had taught that the effective way to overcome machine guns demanded gunfire, and artillery interdiction to prevent their support or reënforcement. Notes of telephone messages to Corps and 4th Brigade show that Division Headquarters was throughout in close touch with the operation.

The 6th Marine report dealing with this affair is distinguished by brevity. After reciting the attack order, it proceeds:

> This operation was successful, the position occupied, consolidated, strengthened and was held by the 3d Battalion until its relief by the 2d Battalion of the 142 Regt., 36th Division, on the night of 9-10 October.

The report of the 3d Battalion, 6th Marines, is not much longer. It notes some short firing from friendly artillery, which likewise troubled the 23d Infantry. No operation report from the 23d Infantry is available.

The 36th American Division had had no combat experience. Without its artillery and engineers, it was hurriedly taken from its training area, and on September 28 placed in French 4th Army Reserve. As the 2d Division had learned, assignment to French Army Reserve foreboded heavy action. The 71st Brigade when it relieved the front-line units of the 2d Division fell heir to an unusually hard situation, which was not simplified by the mechanics of the sector occupation. It was not under its own division commander; it held the entire division front; two brigades were in support and guarding its flanks, but they were exhausted; and it had a stiff fight on its hands. This first engagement proved a harsh schooling, and Colonel Otto is eminently fair in recognizing its difficulties. The October 8 attack met bitter resistance. The 2d Division operations report summarizes the events:

> The 2d Division remained in position prepared to follow and support any advance made by the 71st Brigade.
>
> The line was advanced from one-half to one kilometer. On the left, a battalion of the 4th Brigade, which was used for combat liaison between the 71st Brigade and the 7th French Division, took and organized for defense St. Etienne-à-Arnes, which had previously been partially occupied by the French. . . . .
>
> About 6:00 P.M. a determined German counterattack, preceded by a very heavy barrage, forced part of the front line to fall back on the support battalions. It however was again pushed forward. The 71st Brigade suffered severely from this barrage and counterattack.

Another 2d Division report states:

> On the morning of October 8th, another attack was made. The 71st Brigade attacked to the front with its flanks protected by combat groups of the 2d Division. The line was advanced somewhat, especially on the left, where a battalion of the 4th Brigade took and organized for defense St. Etienne, which had previously been partially occupied by the French. Late in the afternoon a determined German counterattack preceded by a very heavy barrage forced a partial withdrawal of the front line. This line, however, was restored when the barrage ceased.

While Monograph No. 9 makes no reference to the afternoon counterattack of the Jägers of the German 195th Division, these extracts support Colonel Otto's comment that the withdrawal of the American lines northeast of St. Etienne was in fact due to the counterattack, and was not voluntary.

The German 3d Army, casting up its accounts for October 8, optimistically re-

ferred to the day's operations as a serious defeat for the enemy.

The 36th Division took over the sector from the 2d Division on October 10. It continued to the north, and was relieved at the Aisne after very creditable operations. Its last action, which again fell to the lot of the 71st Brigade, was the capture of Forest Ferme. The division had been engaged for twenty-three days. Transferred to the American 1st Army, it arrived in its new area only on October 31, and was not in line in the Argonne fighting.

It may be of interest to contrast the dispositions of the 36th Division upon completion of its relief of the 2d Division, with the basic 2d Division dispositions. The 36th had its brigades in column, regiments abreast in each brigade; the 2d had brigades abreast, regiments in column in each brigade. This "square" four-regiment two-brigade organization is a source of frequent discussion. The two methods of employment here used in the same sector well illustrate its adaptability, quite apart from its recognized offensive and defensive power.

The twenty-six maps in Colonel Otto's study represent painstaking research and compilation, and are of very great value for permanent record. The official photographs reproduced are excellent. There are several errors in unit designation in the text: the French 21st Division's mixed detachment (October 3) operated under 11th Corps orders; on October 6 the French 73d Division was on the right of the 9th Infantry; on October 8 an engineer battalion and the 4th Machine-Gun Battalion relieved the liaison battalion of the 9th Infantry. The engineer element of the 2d Division, the 2d Engineers, was a regiment, not a battalion. Appendix II needs revision. The French 167th Division, not the 67th, relieved the French 170th Division on the night of October 2-3; incorrect reference to the 67th recurs many times in Monograph No. 9. There was no French 346th Division, but the 346th Infantry Regiment was one of the regiments of the French 73d Division, which should be shown in line from October 4-5 to the end of the operation. The insertion of the 170th Division at the 2d Division left on October 3 did not transfer it temporarily from the 21st to the French 11th Corps, as the army corps lines in the diagram might indicate, though its operation here was largely in the 11th Corps sector.

Blanc Mont to a member of the 2d Division means the hardest, most ruthless fighting of all the battles in which the division was engaged. On October 1 it had present for duty 1,131 officers and 26,574 men. By October 10 casualties had reduced it to 922 officers and 21,803 men. Its infantry brigades lost some 30 per cent of their effective strength. It was hard for us; what about the other side? Colonel Otto's thorough work answers this query, and it is welcomed as an important contribution.

Two Recently Developed Acoustic Depth Sounders

(See page 953, November, 1929, PROCEEDINGS)

COMMANDER B. V. MCCANDLISH, *U. S. Navy.*—The *Maryland* is fitted with the indicating acoustic sounder described in Lieutenant Delsasso's article published in the November, 1929, PROCEEDINGS.

This equipment has been of great value in navigating the vessel during low visibility conditions which prevail for a large part of the time off the Pacific coast.

Lieutenant Delsasso's article shows that effort was made to make the sounder sufficiently rugged to be used consistently by seagoing personnel. This has been accomplished. The radio personnel have little difficulty in keeping the equipment operating and every quartermaster's striker aboard can take accurate soundings with it. The equipment is used with the 540-cycle oscillator and gives accurate readings between 30 and 4,000 fathoms. It is easy to test whether the constant-speed motor is operating at proper speed since for soundings over 400 fathoms the indicating pointer rotates once in ten seconds and for depths below 400 fathoms it rotates once a second. Timing of this pointer with a stop watch checks the accuracy of the soundings provided the outgoing signal is at zero mark of the scale. This latter adjustment is easily made.

Upon getting under way it is routine to test out the sounding equipment and necessary adjustments are made. Radio personnel assist in this but thereafter soundings are obtained by the quartermaster or his striker.

When operating off San Pedro, in rounding Cape Mendocino, and in making land-

fall off the entrance to the San Juan de Fuca Strait, and at other times, the depth sounder has fixed the ship's position within a mile.

With this equipment passage was recently made from Puget Sound to San Francisco. After passing Cape Flattery only one light was sighted and no star or sun sights were obtainable. Bearings were had from all the naval shore radiocompass stations passed and with the ship's radiocompass from the various radio beacons operated by the Bureau of Lighthouses. By using the information available from these sources navigation in the foggy weather prevailing was safe and at no time was the position of the ship unknown within the limits of astronomical navigation obtainable with the hazy horizons usually met with in these waters.

It appears that there may be a valuable application of this kind of navigation to the coastwise shipping routes. The sailing directions usually read that vessels pass lights at certain distances, the same distance being given for both north- and south-bound traffic. These directions were written before radio fog aids were efficient and before sonic depth finders were perfected. It would appear that a system similar to the trans-atlantic steamer lanes could be evolved for coastwise shipping. North-bound vessels, for example, could be routed to pass light vessels (Pacific coast) at distances from one to five miles and south-bound traffic would pass the light vessels not closer than five miles. Since the important light vessels have radio beacons, the ships could get bow, beam, and quarter radio bearings and with soundings it would not be necessary to see the light vessel. Lanes such as described would reduce the probability of collisions during foggy weather.

Fog navigation has been made much safer by ship and shore radiocompass bearings and these used in conjunction with sounding devices such as Lieutenant Delsasso's cause one to wonder how mariners managed a few years ago without them. One of the great advantages of the Delsasso depth sounder is that soundings are immediately available in the chart house without the delay incident to reading scales, hauling in lines, etc.

It is impossible to work with the equipment and not be enthusiastic about it.

The Spherant

(See page 607 this issue of the PROCEEDINGS.)

LIEUTENANT COMMANDER GEORGE R. FAIRLAMB, JR., *U. S. Navy.*—The initial reaction of a navigator employing the Kaster position finder is distinctly unfavorable because of its formidable appearance compared with a sextant, and the uncomfortable and strange position of the arms and hands in taking a sight. If the navigator has had no experience with bubble-type sextants or octants, his unfavorable impression of the instrument is amplified and he proceeds to find no health in it.

With the exercise of a little patience and practice in taking sights this impression fades rapidly and the speed and accuracy of solution assume paramount importance in the operator's mind. After an hour's study and practice I felt comfortable in taking sights on the ground and was ready to have a try in the air.

One of the most damning characteristics of bubble-type sextants in aircraft is their tendency to give inaccurate readings and the errors in aircraft may be fifteen or fifty miles in error, depending on the air conditions, the operator, and *the instrument.* Bearing this in mind, we gave the Kaster position finder a trial run with considerable skepticism. The errors were uniformly so low that to my mind the instrument demonstrated its practical value and earned the right of development in the air-navigation field.

Commander John Rodgers was wont to take horizon sights because he distrusted results in the air from bubble instruments, and other transocean air navigators have done likewise. Yet this defeats the very purpose for which such instruments are designed. If then we can develop an instrument that will give small errors while at the same time being practical and having an added advantage of speedy and nearly foolproof solution, celestial navigation of aircraft will have passed into its last phase. The unconventional but highly ingenious instrument of Mr. Kaster appears to make a very strong bid for this honor.

PROFESSIONAL NOTES

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COMMANDER D. B. BEARY, U. S. NAVY
LIEUTENANT COMMANDER D. C. RAMSEY, U. S. NAVY
AND
PROFESSOR HENRY BLUESTONE, U. S. NAVAL ACADEMY

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UNITED STATES

New Cruisers Further Delayed

Baltimore *Sun,* May 3.—Further delays will occur in the laying down of three cruisers whose construction was ordered postponed by President Hoover at the beginning of recent naval reduction discussions.

The latest delay today was ascribed to contemplated changes in design and was said to be in no way connected with the result of the London conference.

These ships were assigned for construction last summer and were included in the first five to be built under the latest Navy construction program. The other two of this group are now under way in private yards, while these three are to be built by the Navy.

They are 10,000-ton ships, carrying 8-inch guns. The Navy has just received the first ships of the type which were authorized in 1924, and the changes were understood to be a result of the trials undergone by these vessels. Improvement in the hull design is planned. Another month or two may elapse, it was indicated, before the keels are laid.

GREAT BRITAIN

New Submarines

London *Times,* May 15.—A very unusual event in post-war naval construction will take place at the Vickers-Armstrongs' works, Barrow-in-Furness, on Wednesday, June 11, when three submarines will be launched. They are the *Regent, Regulus,* and *Rover,* belonging to the 1928 program, and sister-ships of the *Rainbow* at Chatham Dockyard. In the two previous years the submarines ordered from Barrow were put afloat at intervals of about a month between each. After the launching of the three on June 11 there will be no British submarines on the stocks. The six authorized in the Navy estimates of 1929 have not been proceeded with by the present government. Three were canceled in January last, and the construction of the other three was suspended until after the conclusion of the London Naval Conference.

Chatham, England, May 14.—The submarine *Rainbow,* of 1,475 tons, first of her class in the Royal Navy, was launched today. There are three other submarines of this class and twelve others in hand, to replace thirty-six submarines which automatically will become obsolete by the end of 1932.

If no more are laid down the British submarine strength then will be cut from fifty to thirty.

New Naval Construction

The Engineer, April 25.—H.M.S. *Leander,* the only remaining cruiser of the 1929 program, is about to be laid down at Devonport. The other two ships, it may be remembered, a 10,000-ton and a 6,000-ton cruiser, were canceled recently, in order, it was assumed, to facilitate the disarmament negotiations. There is, however, a strong probability that the 6,000-ton ship will be restored, as her early construction is necessary if the British quota of 6-inch gun cruisers is to be reached by 1936. Although no official details are available, the *Leander* is believed to be designed for very high speed and an armament of eight 6-inch guns, mounted in twin turrets along the center line. Electric welding may be utilized in the building of the hull. She will be the first of a new type, many of which must be built in the next five years. In fighting value she will come between our D-class cruisers and the American *Omaha* group, but there can, of course, be no comparison between this design and an 8-inch gun ship, which is immeasurably superior in military power. The remaining vessels of the program are to be distributed between the dockyards and private firms. Devonport is to be responsible for the sloop *Bideford,* Portsmouth for the destroyers *Crusader* and *Comet,* and Chatham for the sloop *Rochester,* while the flotilla leader *Kempenfelt* and the destroyers *Cygnet* and *Crescent* will be built by contract. There is a feeling in shipbuilding circles that the royal yards have been unduly favored on this occasion, and the hope is expressed that a fairer distribution will be made of such work as is to be undertaken this year, the extent of which has yet to be announced by the government.

JAPAN

New Cruiser

Baltimore *Sun,* May 3.—In the presence of the Empress Nagako, presiding for the first time at such a ceremony, the 10,000-

ton cruiser *Takao* will be launched May 12 at the naval arsenal of Yokosuka, principal base of the Japanese Navy.

This will be the most elaborate naval fête of its kind in Japan since the Washington conference ended the launching of capital ships, and Yokosuka will be aglitter with the gold braid and decorations of the highest dignitaries of the Navy and other branches of the imperial government.

The *Takao,* laid down in April, 1927, is the fifth of her class. The sixth of this sister-hood, the *Atago,* is scheduled for launching at the Kure naval base June 15. She also was started in April, 1927. Both should be completed within a year after launching.

Although the London conference succeeded in placing relatively low limits for the American, British, and Japanese cruiser fleets, the London treaty means for Japan, as for the United States, an actual increase of her present cruiser tonnage. Hence, the construction program which the Japanese Navy had in hand when the conference was called has gone forward without slackening. That program's provisions for cruisers carrying 8-inch guns will be completed in full, giving Japan the 108,400 tons to which the treaty limits her in this category.

Even before this building is finished Japanese shipyards, saved from five years of idleness by concessions obtained by Japan for that express purpose, will begin work on 50,955 tons of light cruisers which the London agreement permits Japan to place on the ways before the end of 1936.

The launching of the *Takao* and *Atago* will emphasize the fact that Japan will retain a lead over the United States in big cruisers until 1934 at the earliest. America has completed only two ships of this category—the *Salt Lake City* and the *Pensacola*—has six others launched or ready for launching, and has two more started.

The *Takao*-class cruisers compare favorably with any other 10,000-ton cruisers now afloat. Their designed speed, thirty-three knots, exceeds that of the American or British cruisers, while their ten 8-inch guns apiece make them the equal of any in hitting power. In horsepower their 100,000 rating is a little below the 107,500 of the new American cruisers, but above the 80,000 of the British.

The *Takao* and *Atago,* like all their sisters, are named for mountains rich in religious and historical associations, the former for a temple-crowned eminence northwest of Tokyo and the latter for one of Kyoto's famous ring of seven hills. Relics from the temples on the mountains are enshrined aboard each of these ships in miniature sanctuaries, at which the bluejackets and their officers worship the national deities.

ITALY

Flotilla Leader "Nicoloso da Recco."

Engineering, May 2.—In his paper, "Sea Trials of Flotilla Leaders," read at the recent meeting of the Institution of Naval Architects, Lieutenant Colonel F. Dondona, of the Royal Italian Navy, gave particulars of the trials of six vessels having a greater displacement than destroyers and known in Italy as *Esploratori,* or scouts. He stated that, although of larger dimensions, these vessels corresponded to what are styled flotilla leaders in this country. These scouts, of which twelve were ordered in 1926, belong to the *Navigatori* class (improved *Mirabello* type). The most recent addition to this flotilla, the *Nicoloso da Recco,* which is to be the leader of the *Navigatori* scouts, underwent her official speed trials on April 3, during which she attained a speed of 41.504 knots. The vessel was built at the Ancona shipyard of Messrs. Cantieri Navali Rioniti, Genoa. She has an over-all length of 352 feet, a length between perpendiculars of 351 feet, a breadth of 33 feet 6 inches, a depth of 20 feet 8 inches, and a displacement of 2,000 tons. The propelling machinery comprises two sets of geared turbines, together developing about 65,000 s.hp. Steam is supplied by four water-tube boilers. The outstanding feature of the *Nicoloso da Recco* is that, with the speed attained during her trials, she appears to be the fastest ship of her type yet built. We believe that the previous record for destroyers was held by the French vessel *Bison,* which reached a speed of 41.2 knots in February last.

MERCHANT MARINE

Construction Program Under the Jones-White Act

Marine Journal, May 1.—The first speaker under this head was J. L. Acker-

son, special expert of the Bureau of Construction of the Shipping Board. Mr. Ackerson said, in part:

The aggregate of loans authorized by the Board total approximately $73,000,000, of which amount substantially $34,000,000 have already been advanced, while repayments to the loan fund amount to about $4,000,000. The interest rates on loans advanced vary in amounts on vessels engaged in foreign trade and have actually covered a range of from 2¾ per cent to 3⅝ per cent. The interest rate is fixed by the act to be the lowest rate of yield to the nearest one-eighth of one per cent of any government obligation bearing a date of issue subsequent to April 6, 1917 (except postal savings bonds), and outstanding at the time loan is made by the Board, as certified by the Secretary of the Treasury to the Board upon its request. The rate is thus fixed by the market value of the security at the time the loan is made. This accounts for the wide variation in rates.

The award of mail contracts to various steamship operating companies which call for certain new construction will make necessary, it is estimated, additional loans to the total extent of approximately $125,000,000 during the next five years and will provide work for the shipyards of the country practically to full capacity.

In the administration of this act the Shipping Board has adopted a definite course of action.

"1. To assist responsible owners and operators to build vessels to be operated in the foreign trade; and in certain instances to assist in the reconstruction or reconditioning of existing vessels in order better to fit them for operation in the foreign trade.

"2. To assist the owner in obtaining a design of vessel best suited to his needs; and to make available to him and to the builder the facilities for research and the results of experience of the technical staff of the board and of the Navy Department.

"3. To insure that the safety of the vessels at sea shall be the greatest possible consistent with the commercial and operating requirements of the vessels for the trade in which they are to operate.

"4. To insure that, so far as is practical without impairing the commercial operating efficiency of the vessel, the vessels on which loans are made will meet the military needs of the Navy in time of emergency.

"5. To make every endeavor to insure that loans are made only to those owners and operators that in all probability will be able successfully to maintain over a continued period the service in which the vessels are to be placed.

"6. To endeavor to limit the loan to such amount and for such periods as to insure that the vessels themselves will at all times be adequate security to protect the government against loss in case a default occurs."

To date the request for loans have, in part, come from established shipowners or operators and for vessels of the better class; namely, combination passenger and cargo liners of moderately high speed and tankers.

All of the new vessels on which loans have been made will be valuable and creditable additions to the Merchant Marine and will be useful vessels to the Navy in any emergency.

Without in any way endeavoring to dictate the design of vessels on which loans are to be made, the Board makes every endeavor to assist the owner in obtaining a design that meets good engineering and naval architecture standards.

In the administration of this construction loan fund, the Shipping Board has very definitely in mind that the object is to create a Merchant Marine that will be a credit and benefit to the government for both commercial and national defense purposes. To that end the Board is receiving the unqualified support of the Navy, the shipowners, and the shipbuilders.

The Shipping Board proceeds on the theory that all branches of the marine industry will continue to utilize its highly specialized facilities for the upbuilding of a modern merchant marine that must operate successfully under unusually keen conditions of competition.

The support and coöperation of all concerned is absolutely essential if the administration of the act is to meet with the approval and support of Congress and the American public.

A Plan for Federal Merchant Marine Training

Nautical Gazette, May 24. By R. R. McNulty.—Why, at the recent shipping conference in Washington, were there no expressions of shipowners' views on the subject of training officers for the modern fleet we are to operate under the provisions of the Jones-White Act? And "how come" no shipowner was appointed on the committee to study this important subject?

Is the topic boring or overrated to the owners, or is it an issue of interest only to the venerable Andrew Furuseth, officers' associations, and others who do not employ ship personnel? And the Navy, too. Are they satisfied with a merchant marine naval reserve as is, or do they desire something along the lines of the reserves maintained by other sea powers—say the Royal Naval Reserve of Great Britain?

The writer of this article was told recently that any effort made to gain the interest of the shipowners in this vital subject would be useless and somewhat analogous to the famed story of the bull dashing out his brains after a feverish attempt to make an exit in a four-foot wall. The writer was told that with the exception of a few owners such as James A. Farrell, Clifford D. Mallory, the American-Hawaiian Line, and one or two others, the vast majority simply don't give a hoot about trained men whether aboard their vessels

or in their offices. Concentration, it seemed, was upon government loans, mail contracts, etc.,—the owners were doubtful, it appears, of any success in international competition obtained by use of trained brains.

The writer's informant was apparently convinced that American shipping, entirely dependent upon government aid and oblivious to utilization of sharpened wits in keen competitive international trade, cannot survive.

There may be much logic to his reasoning, but it is hoped that both the shipowners and the Navy will come out of their trance before it is too late. Yankee ingenuity, which has given our shore industries mass production and supplied the exportable surplus upon which rests the economic necessity for an adequate American artery of overseas transport, also exists in the shipowner, and needs but the impetus to revive it from the seance chamber.

Shipowner recipients of construction loans at low interest and juicy mail contracts will within the next few years be compelled to construct scores of modern and fast vessels. To officer this new fleet, which will consist mainly of combination passenger types, it is estimated that about 1,000 deck and engineer officers will be required. At the present time our state schoolship system takes care of about 15 per cent of personnel needed to man our vessels—the rest comes up from the forecastle. Should the owners of these mail-carrying, modern vessels worry about trained officers or will they benefit more by their *laissez-faire* attitude looking to the forecastle for their officers? If our competitors—those who will do their utmost to take away the cargo and passengers for which our new fleet must compete—have trained men and utilize all the wrinkles the trained men have at their command, then there should exist logical reasons why we too should train.

Unfortunately, the subject of training is a very debatable one. Certain groups are opposed to schoolship training and would prefer the forecastle route; other groups would open the present state schoolships to citizens of inland states; another would utilize resigned graduates of the Naval Academy and still another would copy the British system.

The committee appointed at the shipping conference in Washington, on which there is no shipowner or representative of the Navy, is considering all suggestions and probably will make a thorough research on the subject. The results of the committee's study should prove interesting.

No doubt the committee will make a deep study of the British system. Great Britain is our chief competitor and naturally it is wise to know something of her methods. In this matter the British owners have had the jump on us. The total British schoolships have about 1,000 enrolled cadets, which compare with the 300 on our three state schoolships. For enlisted personnel, seamen, cooks, etc., there are a dozen or more schoolships and shore institutions. One, the Gravesend School, is maintained by the Liverpool owners, with due coöperation from the seamen's union.

The British schoolship cadet on the *Worcester, Conway,* and at Pangbourne is usually from the so-called better class—he must be able to pay the tuition rate of about $1,000 per year.

Do the British find schoolship graduates desirable? Travel on an American passenger ship and search for junior officers eating with the passengers, speaking their language, and building up patronage for their owners—then travel on an Anchor liner and compare. Put an American merchant marine naval reserve officer on a man-o'-war and note his bewilderment; then put a British royal naval reserve merchant officer on the same ship or even on a submarine and make a comparison.

The committee appointed in Washington may learn much from the British and Germans. They may also find that none of the foreign systems in their entirety will fit the requirements of America where some attention must be allotted to a study of incentive for the American youngster to follow a merchantman career. Here we have not many youths, who will pay $1,000 a year for a calling which has fallen from a profession to a trade, nor have we a Prince of Wales to hand out diplomas.

Probably it would be better for America to take from Britain and other foreign systems that which may fit here and with it mold the advantages of suggestions made by Americans who have knowledge on the subject, shipowners like James A. Farrell

and Clifford Mallory and naval officers, such as Admiral Moffet and Commander Rutter.

Possibly the following, an attempt at molding, would offer a basis for thought:

U. S. MERCHANT MARINE ACADEMY

1. Administrative Board.
   (a) Chairman of Foreign Trade Council.
   (b) Secretary of the Navy.
   (c) Secretary of Commerce.
   (d) A prominent shipowner.
   (e) A prominent shipbuilder.
   (f) Head of a deck officers' association.
   (g) Head of an engineers' association.
2. Establish school at
   (a) Coast Guard Academy, New London, transfer cadets of that school to the U. S. Naval Academy, where the number of midshipmen may be reduced in near future. If this cannot be arranged,
   (b) From War or Navy Department obtain a site, such as Fort Schuyler on Long Island and start alteration of present structures or build anew.
3. Abolish present state schoolships and divert sums now used to national school.
4. National school to be maintained by appropriations of Navy and Commerce Departments. The commandant to be appointed by the Secretary of the Navy from the ranks of the Merchant Marine Naval Reserve, given rank of rear admiral while commandant. The Secretary of Commerce will appoint a dean of economic studies.
5. Cadet appointments will be made as in the case of West Point and Annapolis, and cadets will receive the same benefits while at academy. Their rating shall be midshipman, U.S.N.R. Preference in appointment will be made to merchant seamen who have served at least one year at sea. Provision to be made for appointment of twenty-five each year by the Secretary of Commerce.
6. The course will be for three years, and will start with a cruise under sail, leaving New York in April. Arriving back in September, those who will not make seamen will be dismissed and the balance taken ashore for study. The first school year will be general for all cadets and the next cruise will be made in a cargo-carrying merchantman, upon which the cadets will work with members of the crew, both on deck and below. Returning in September the cadets will select specialization on deck or in the engine-room. The next summer will be devoted to steamship office and dock work for deck cadets and shipyard work for the engineer cadets. Graduation will take place in May, but cadets will remain at academy until appointed to apprentice officer berths by shipowners or government services.

The expenses of maintaining a sail cruising vessel will be borne by the shipowners. Cruise in cargo vessels will be by allotment to different lines. Maintenance of cadets while in shipping offices, on dock, or in shipyard, will be borne by their temporary employers on a weekly wage basis.

7. Upon graduation (diplomas handed out by Secretary of Commerce) the cadets will become
   (a) Apprentice officers, junior watch officers, and
   (b) Passed midshipmen, U.S.N.R.

After one year's service they will be permitted to sit for a second mate or second assistant's license and will receive commissions as ensign, U.S.N.R.

Such a school should provide good material for not only the merchant service, but also shipping officers and government services such as naval auxiliary, Army transport, Coast and Geodetic Survey, Army engineers, lighthouse tender, Navy hydrographer, and many others.

ENGINEERING

Vulcan Gearing and Hydraulic Couplings

The Marine Engineer and Motorship Builder, May, 1930.—One of the most important marine engineering developments of the last few years, and one which has made a very material contribution to progress both in the stream and in the Diesel engine fields is the flexible hydraulic clutch or coupling, originated by the inventions of Professor H. Foettinger, but since greatly extended in the scope of its application by patents granted to Dr. Gustav Bauer. In its latest form, as used in association with mechanical reduction gears, the hydraulic coupling has been developed

by the Vulcan Werke, Hamburg, and hence the combination has come to be known as the Vulcan gear. In the internal combustion engine field the disadvantages associated with the uneven torque developed by the various cylinders and the large dimensions necessary for high engine powers can

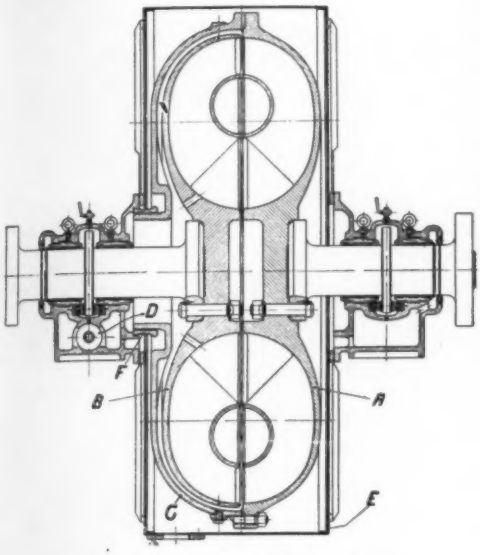


FIG. 1. VULCAN HYDRAULIC COUPLING OF LATEST TYPE

be almost wholly eliminated as to the first by interposing a hydraulic coupling between engine and propellers so that torque fluctuations are not transmitted. As to the second disadvantage, the fitting of a hydraulic coupling and a pinion to the Diesel engine shaft with a gear wheel on the propeller shaft makes it practicable to secure the saving in weight of high-speed Diesel engines while retaining the most efficient propeller speed. By multiplying the number of pinions and gear wheels it is possible to couple a number of small engines to the propeller shaft instead of a large and heavy, slow-running Diesel engine. In steam engineering the application of the hydraulic coupling in association with double-reduction mechanical gearing, as exemplified by the Bauer-Wach system, has led to the rapid development of this system. The success of the Bauer-Wach system of today would have been equally possible fifteen years ago had a reliable hydraulic coupling then been available.

The hydraulic coupling as illustrated in Fig. 1 consists of three main parts, viz., a driving or primary wheel A, the driven or secondary wheel B, and the shrouding cover C. The primary wheel A and secondary wheel B are arranged concentrically opposite one another with a clearance of

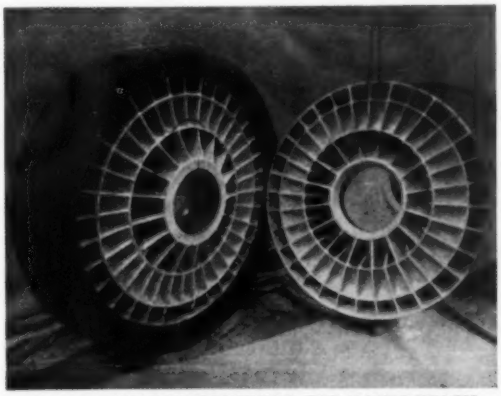


FIG. 2. VULCAN COUPLING FOR BAUER-WACH INSTALLATION

The primary half of the coupling is incorporated with the first reduction wheel.

about ¼ to ⅝ inch according to the size of the coupling. There is no rigid connection whatever between the wheels, and the space inside and between the driving and driven wheels is filled with a fluid which may be water but is almost invariably lubricating oil. An excellent impression of the construction of the Vulcan coupling will be gathered from the photograph which we reproduce in Fig. 2, which shows part of a Bauer-Wach exhaust-turbine drive. On the left of the illustration is the primary wheel of the coupling combined with the first-reduction gear wheel. The secondary wheel of the coupling is in the center, and the shrouding cover of the coupling is on the extreme right. As the primary wheel revolves the contained fluid is driven to the periphery by centrifugal force. The fluid, in consequence, enters the stationary secondary wheel, and since the latter does not develop any initial centrifugal force, the fluid can reënter the primary wheel to be thrown again to the outside by centrifugal force. The constant flow of driving fluid passing the radial blades starts to drive the secondary wheel, but even under full running conditions the speed of the secondary wheel is always slightly less than that of the primary wheel. It follows,

therefore, that the centrifugal force of the primary wheel is always greater than that of the secondary, and there is thus a constant flow from primary to secondary. The larger the diameter of a coupling designed for a given output and revolutions the smaller is the slip between primary and secondary members. In practice the diameter is usually so proportioned as to correspond with a slip of 2.5 to 3 per cent. In order to prevent the escape of the driving fluid through the relatively large clearance space between the two wheels a shrouding cover is bolted on to the primary or secondary half, covering the opposite half from the outside where the driving fluid enters. Due to centrifugal force the fluid remains near the periphery, but the fluid friction between cover and coupling is negligible, since the difference in the speed of rotation of the two parts is equal to the slip velocity. This coupling represents a practical application of the physically interesting feature of the vortex ring. One may imagine the movement of the driving fluid as though the elements were circling round the circumferential axis of a rotating vortex ring exactly as the elements of a smoke ring blown by a smoker. This action will become apparent from Fig. 3, which shows the core of a hydraulic coupling.

The efficiency of these couplings remains constant for all speeds of the ship, since the ship's propeller and the hydraulic coupling take up the output according to the same law. For a constant output and slip the dimensions of the coupling decrease with increasing number of revolutions. On the other hand, it is possible, keeping slip and revolutions constant, to transmit considerably increased powers by increasing the diameter—a fact which shows that Vulcan couplings are especially suitable for use with large high-speed power units. If the necessary space is available the coupling can be designed with a slip as low as 1 per cent but experience has shown that couplings with a slip of about 3 per cent represent the most economical proposition in practice. Due to the fluid friction the power lost in the coupling is transformed into heat, and in order to avoid an increase in temperature inside the coupling small holes are arranged in the circumference to allow a certain amount of the driving fluid to drain off. This leak-off fluid is returned to the coupling—if necessary through a cooler—by means of a small pump. For maneuvering purposes a perforated emptying ring is arranged externally to and sliding upon the circumference of the coupling, the number of holes in this ring being designed to empty the coupling within a period of from 2 to 3 seconds on an average.

FIG. 3. DIAGRAM ILLUSTRATING ACTION OF VULCAN COUPLING

The following table shows the maximum profile diameter in inches required for these couplings at various powers and speeds. The dimensions given are based on a calculated slip of 2.8 per cent and working with lubricating oil.

Output per coupling	Revolutions per minute					
S.hp.	200	300	400	600	800	1,000
	In.	In.	In.	In.	In.	In.
250	70.2	54.4	46.1	36.2	30.75	26.8
500	80.4	62.6	53.2	41.8	35.4	31.1
1,000	92.2	72.0	61.1	48.1	40.6	35.4
2,000	106.0	83.1	70.1	54.8	46.5	40.6
3,000	115.0	90.3	76.0	59.9	50.5	44.1
4,000	122.0	95.8	80.9	63.0	53.2	46.5
6,000	132.1	103.5	87.4	68.2	58.0	50.9
10,000	146.5	114.5	97.0	76.0	64.3	56.0

AVIATION

Details of the Armstrong Seadrome

Engineers and Engineering, March. By Edward R. Armstrong.—Ocean flying to be popular and useful must be safe and profitable. It is not so today. An effort to span the ocean in a single flight is a gamble, with death many times the winner. Flying over the ocean is not in itself dangerous. The danger is inherent in the distance that must be traveled without refueling, motor inspection, weather reports, or any of the other services that have made land flying commonplace and reliable. It is obvious and axiomatic that ocean airways to be successful must pay. To be profitable, the transportation service they offer must be at rates that will attract traffic. In any type of plane, now developed or proposed, equipped for ocean flying, the economic flight range will not exceed five hundred miles, and it will require almost an engineering miracle to extend this pay-load range to a thousand miles. Therefore, to establish a safe and economic airway operation between Europe and America, the obstacle of distance must be eliminated.

Since distance is the only difficulty, the problem in establishing ocean airlines is to shorten the distance, to break it up into intervals, comparable with those distances found to be essential and practicable for overland routes. This is the purpose for which the Armstrong seadrome is designed. A series of eight of these structures, anchored to the bottom of the Atlantic at intervals of approximately 375 miles, will remove the hazard from ocean flying, and permit a paying operation daily, at rates little or any in excess of those now charged by the high-speed steamship lines.

At first thought, it would appear impracticable if not impossible to anchor a ship-shaped structure of sufficient deck area to serve as a floating flying field, in the deep waters of the North Atlantic, and I am in hearty agreement with such an opinion. A seadrome is not a ship, subject to the shearing and bending forces of large waves, but a deep-draft, open-work structure constructed so as to permit the wind and waves to pass through it with practically no disturbance or loss of energy. Waves do not roll or pitch it even in the fiercest storms, because so much of its displacement is in the relatively still water under the wave disturbance. Stability is insured by having the center of gravity below the center of buoyancy. Streamline shape for the support columns, the deck, and deck housing, opposes minimum resistance to the wind; so that in total the drifting forces of wind and waves can never be such as to endanger the anchoring system.

The seadrome deck is 70 feet above the sea level, 1,100 feet in length, 340 feet wide in the central section, with extensions, on either side of the 180-foot central runway, to provide hangars, shops, stores, restaurants, and hotels. About 7,500 tons of steel and iron make up the deck system, with 10,000 tons in the substructure or buoyancy system. Iron ore ballast of 10,000 tons makes the total light draft displacement 27,500 tons. On sea duty, where the draft is 175 feet, and water ballast is in place, the final displacement will be 50,000 tons.

Below the deck landing, at the stern, is the service and boat deck. In addition to the lifeboat equipment provided, large sea sleds, radio equipped, are available for patrol and rescue work between seadromes, should it be impossible to perform this service with flying equipment, due to extreme weather hazards.

Each seadrome will be a unit in itself, with hotel accommodations, a power plant of 750 kw, radio station, and weather station. The hotel accommodations are planned to serve both the operating personnel of the seadrome, and the flying personnel of the airway that may be on duty there, and in addition, an equal number of transient guests, a total of approximately 160 people.

A very complete system of navigational aids are provided for the guidance of the planes flying over the route; the directional radio beacon system, developed by the U. S. Bureau of Standards, insures accurate and visible means of guiding the pilot at all times between the stations. On the visible indicator radio beam system of navigation, keeping on the course between seadromes is as simple as observing a speedometer in a motor car. Radio communication between station and station, and between station and planes, permits traffic control and accurate knowledge of flight conditions during the whole voyage. In addition to these special

aids, both planes and seadromes will be provided with those aids now ordinarily used in overland airway operation. Flood lighting of the seadrome will make night landing as safe and accurate as its counterpart during the daytime.

An important feature of the seadrome operation is the supply service, by means of which all the operating materials and supplies are delivered to the dromes by ships especially adapted for this service. Gasoline and oil will be delivered by tankers to supply tanks in the buoyancy units below sea level at the stern of the seadromes. The supply ships are, when necessary, to be protected from waves by air breakwaters, which effectively destroy wave motion through diffusing compressed air from perforated pipes. The air is released from the ballast tank system about 160 feet below normal sea level, so that the rising air bubbles break up the waves, reducing a 30-foot wave to a minor turbulence. A safety zone, about 250 feet wide and 600 feet long, will be maintained by this method when servicing operations are going on, should it be necessary. By the use of this system, supplies can be transferred from ship to drome under virtually all weather conditions met with at sea. The same system can be used when refueling large flying boats, too large to land on the deck or be hoisted to it by the derrick equipment.

While the seadrome system is normally designed for amphibian-airplanes, capable of landing on the water or on the land, as the conditions may require, it is feasible for multi-motored land machines to land on the deck, or for the refueling servicing of the largest flying boats to be done in the artificial harbor provided by the compressed air system. Undoubtedly, all three types of planes will be developed and used, because of their special fitness for certain forms of service required on the transatlantic route. It is obvious that refueling in the air from a seadrome will be a very practicable and efficient method of procedure, in those cases in which it is desirable to make the flight a continuous one.

Associated with the development are some of the foremost engineers and technical men, experienced in marine construction and operation. Their participation can be taken as a guarantee of the feasibility and practicability of the seadrome development. It is not usually difficult to convince those taking the time to investigate the proposal, that the seadrome itself can be built at a reasonable price and will function as planned. It is difficult, however, for even technically trained men to become equally positive about the anchorage system and its security under all conditions at sea.

The anchoring depth at the station locations on the transatlantic route is between two and three miles. A simple calculation will show that an anchor chain, such as used by ships, would fall apart by its own weight before it would reach to this depth. Suspension bridge type cables, however, so greatly exceed in strength anchor chains that they have been used in making anchorages in water as much as two and one-half miles in depth upon numerous occasions.

The anchorage cable system, designed by John A. Roebling's Sons Company of Trenton, New Jersey, to anchor the first seadrome, which is to be the first of the transatlantic ocean series, and anchored in the Atlantic, midway between New York and Bermuda, is 17,900 feet in length, made up in six sections varying in diameter from 3.75 inches at the surface to 2.75 inches at the bottom of the ocean. The total weight of the cable system is 325 tons, with an ultimate strength in the surface section of 2,500,000 pounds. The anchorage cable is composed of two parallel cables, which are designed to have a factor of safety of four when they are stressed at the maximum brought about by the wind and wave forces on the seadrome, approximately 200,000 pounds.

The cable system will withstand wave forces on the seadrome brought about by the largest waves on record, coupled with a wind velocity exceeding 160 miles per hour. Because the cables are entirely submerged, they will be subject to but little corrosion. They are further protected by being encased in a special covering, and galvanized steel wires are used, so that the makers anticipate a useful life in excess of twenty years in seadrome service. A special type of universal self-righting anchor has been developed, weighing about 40,000 pounds.

To avoid the hazard of storm, fogs, wind, ice, and sleet, the transatlantic route has been located somewhat south of that normally followed by the steamship lanes.

By keeping south of the 40th parallel, good flying weather will prevail most of the year, with fog almost entirely absent. Preliminary to undertaking the full transatlantic program, one full-sized station is being constructed for test and operation on an experimental airway between New York and Bermuda. The hydrographic department of the U. S. Navy recently completed a special survey of the ocean depths in the vicinity, and found a submarine plateau, approximately four miles by six miles in extent, which is about thirty-six hundred feet higher than the surrounding ocean floor. The plateau is located at 68° west longitude and 36° 40′ north latitude, the depth being 2,100 fathoms or 12,600 feet.

The transatlantic series of seadromes will in effect be an international air highway available to all nations. Their international character is assured because the seadromes do not come under the registration laws of any nation; they therefore can render international service without complications or special treaties. It is not a far-fetched legal consequence of the seadrome and its usefulness in an international way, that the Atlantic seadrome system could be considered a nation with its own powers and jurisdictions, and obtain recognition in international circles. It seems a reasonable possibility for a series of dromes, connected by airplanes and radio, to organize as a state and eventually gain admittance into the League of Nations. A fantastic conception, certainly, but not an impossible one.

According to present scheduled plans, the transatlantic system will be in operation in 1932, in an international way. Assuming international coöperation in developing and operating the airway services, daily transatlantic flights will be made by American, Canadian, British, French, German, Dutch, Italian, and Scandinavian planes, carrying passengers at rates competitive with those now charged on the high-speed steamship lines. With a daily service at reasonable rates, the collective airway organization would transport, in each direction over the ocean, from five hundred to one thousand passengers, in addition to huge volumes of mail and express.

Simplified Brake for Airplane Wheels

New York *Herald Tribune*, May 11.—A simplified brake for use with air wheels has been perfected by the Goodyear Tire and Rubber Company here, it was announced today. The brake has been perfected following several hundreds of hours spent in test landings under all conditions of service.

It was thought that because the air wheel fits directly to the hub the reduction in brake surface circumference would result in insufficient dissipation of heat when brakes were applied in service. It was pointed out, however, that although the brake circumference is reduced, the actual brake surface area is increased as a result of the greater hub length and the fact that the brake surface is practically the entire length of the hub.

The new air-wheel brakes are either right or left hand. They are 75 per cent self-energizing in either direction, and the brake lever and pedal return spring are interchangeable on either end of the actuating axis. Braking is effected by the internal expanding method, a sturdy cylindrical tube covered with molded lining, expanding to contact evenly with practically the entire inner surface of the hub on the application of pressure to the brake arm.

Aberdeen Air Exercises

Baltimore *Sun*, May 18.—The machines of attack and defense, used in the joint aviation and antiaircraft maneuvers which were concluded today, have produced results which would have been impossible of achievement twelve years ago, Army officers stationed at the Blue (defense) headquarters said today.

The three branches of the service which have faced the problems in this mimic war, the Signal Corps, the Coast Artillery (antiaircraft), and the pursuit planes, functioned as near perfect as possible, officers asserted, but the results will not be known until the board of strategy of the Blue forces meets in about a month to discuss the various reports that are being compiled.

Antiaircraft gunnery has improved practically one hundred per cent since the war, Lieutenant Colonel Gerald C. Brant, of the Air Corps, commanding the Blue aërial defenses, said at the close of the maneuvers.

"Guns now can reach to the ceiling of combat planes," he explained, "and the method of control has been perfected to the point where several batteries can be operated as perfectly as one gun

during the war. Factors involved in the question of getting hits still are problematical and must be worked out through such exercises as we have gone through during the week.

"The exercises have been extremely valuable in determining what sort of intelligence system is going to be necessary in warfare to give accurate information."

Colonel Brant pointed out that the altitude to which ships of combat can climb has increased considerably in twelve years, as well as the speed of pursuit, attack, and bombardment planes. The huge twin-motored bombers now can attain a speed of approximately 125 miles an hour, he said, whereas during the war they averaged only sixty to seventy miles. The speed of smaller craft has increased in proportion.

In estimating the number of miles flown by the attack planes during the maneuvers, Colonel Brant said eighteen planes, comprising the Red forces, had flown approximately 6,600 miles from their base presumably at Richmond. The pursuit planes flew about 8,400 miles.

No mishap marred the exercises, and the only complaints were from farmers in the vicinity who feared the noise would affect their cows and chickens.

The low flying, or hedge-hopping, in which some of the bombers participated, especially over Baltimore, was not done merely as a stunt, he pointed out. Low flying for bombers is a part of the game, it was explained.

Lieutenant Arthur I. Ennis, who was stationed at the Red headquarters throughout the exercises and who flew here today, said the attack forces merely were the means of supplying the problems for the defending forces. Their aim was to get through the defenses inside of a set area and they could use any means at their disposal to do so.

Commenting on the effectiveness of aviation forces in war, he said one group of attack planes has the machine-gun fire power of an infantry division. The havoc that such a squadron could produce is quite considerable, he said.

While the tactics employed in this conflict virtually were the same as those used in the World War, Lieutenant Colonel John M. Dunn, Coast Artillery, said there have been great changes as far as technique is concerned. These changes are apparent in every branch of the service employed in the exercises, he asserted.

Application of Carrier Arresting Devices to Commercial Use

New York *Herald Tribune,* May 18.—The problem of opening the wilderness of tall towers and skyscrapers of Manhattan to airplane operation and of creating airport sites out of such limited flat roof-top space as exists in New York, is being studied by the engineers of the Bureau of Aëronautics of the Navy Department, it was learned last week.

It is the belief of the Navy engineers that in the arresting gear which is used to effect the safe return of airplanes to warships and airplane carriers, there lies the key to the possible realization of the once fanciful dream of building suitable landing fields on the top of cities.

The high degree of success which Navy pilots have enjoyed in the apparently extremely hazardous work of flying planes on and off the limited available area of carrier decks is the basis of hope that the revolutionary achievement of having landing fields over cities may yet become a reality.

Air transportation is definitely handicapped when service to large metropolitan areas is considered, where it is necessary to locate land airports at great distances from the center of these areas. A proposal which has been frequently advanced is that of roofing over a portion of the Chelsea dock district on the lower West Side of Manhattan.

If future experiments with the Navy device prove successful, in the opinion of engineers, such an area might easily be adapted to the plan of creating a roof-top airport in New York.

Rear Admiral William A. Moffett, chief of the Navy's Bureau of Aëronautics, speaking at the New York Aircraft Show, revealed that "there is something in the commercial possibilities of this device."

The mechanical stopper of airplanes as used in the Navy is a simple arrangement of hooks and wires. As a plane comes in for a landing a hook is let down out of the bottom of the plane. This catches in wires stretched across the deck to break the speed and to enable the plane to be landed in thirty or forty feet, instead of the several hundred feet required on land.

While there are certain assisting conditions involved in carrier deck landing which would be absent in landings attempted upon

roofs, it is obvious that aids used and all experience developed in alighting on the floating fields of the Navy should be of use where short, fast, and quick landings are necessary. And, because the hazard is frankly realized and caution is never forgotten, the Navy has maintained a remarkably high safety record in this work.

Speaking of this Admiral Moffett said:

"If you think of the largest landing field you have ever seen and the largest number of planes operating from it, and then realize that the landing deck consists only of approximately two and a half acres and operates daily more planes than any single landing field in the world, you can appreciate the skill and ability of the personnel and the value of these ships to the fleet and to the country.

In approaching the problem of adapting the landing principle of the carrier to use in crowded urban areas, Navy engineers, realize that the warship or the carrier is never hidden away among tall towers or smokestacks, as might be the case with an artificial air field raised over the roofs of a city. There must be plenty of visibility for the pilot. A field such as that proposed would have to be in an area not entirely surrounded by taller, structures. This might be overcome, it is said, by placing the field on the top of a tall building.

It is also necessary, Navy engineers say, to remember that a carrier as a landing field is not a stationary unit. It is capable of movement, so that it can always be headed into the wind to assist in making safe landings by reducing the speed of the plane over the water. It also can be moved with some speed, which assists both in take-offs and landings.

One of the limiting factors of the roof airport is the necessity of making the proper field layout for different landings. This might be overcome by placing the field on a turntable.

The adaptation of the Navy's arresting gear for land work would necessitate somewhat larger apparatus because of the wind, and the speed of the plane over the ground could not be reduced as it is in the case of carriers. It might also be necessary to redesign planes in order to take the additional stresses placed upon it by this work.

Future of Air Transportation

New York *Times,* May 4. By Colonel Charles Lindbergh.—Before the era of aviation transportation was confined to two dimensions, and limited in these, to a great extent, by natural obstructions. The world was divided by oceans and mountain ranges and its peoples were separated from each other by distances measured on roundabout paths. Centuries of isolation have caused us to judge distances by imagination rather than by miles. Few people realize that the Panama Canal is more than a thousand miles closer to New York than is San Francisco. Or that the plains and forests of Venezuela are nearer to Manhattan than the ranches of New Mexico or the timberlands of Oregon.

The airplane has carried transportation into the third dimension and above the obstructions of the earth's surface. The air has no boundaries.

International borders become imaginary lines and every city a port of entry. Civilization has always progressed hand in hand with its facilities for transportation. As distances have been reduced in time, commerce has made nations more and more dependent upon one another for the products which go to make up a rapidly rising standard of living. Closer international relations become unavoidable as the vague distances of an old era are measured on a new scale of relativity.

Radio has practically eliminated the element of time from communications and its messages travel over unprepared roadbeds. The airplane also travels a universal road, but it has not succeeded in eliminating time from transportation, although it is faster than any other form of human travel.

We cannot conceive of going somewhere without spending time en route. Perhaps it was just as impossible for our forefathers to imagine talking to someone on the opposite side of the world. The fact remains that as long as time is lost in traveling attempts will be made to reduce the amount that is lost. Since the airplane represents the greatest progress in this direction, it is interesting to study the possibilities it offers toward reducing our ratio of time to distance.

We can look back into the history of air transport in order to forecast its future. Heavier-than-air flight started with gliding. Its only value was along scientific lines and its pursuit was unprofitable financially and extremely dangerous. Gliders were experimented with and improved until the

Wrights found it possible to combine a glider with a light-weight engine and maintain flight under power.

Then began the evolution of the power plane. For years the designers' attention was devoted to finding methods of constructing planes which would not fall apart in the air and in building engines which were not subject to frequent failures. Up to the time of the war very little thought was given to making the plane for any other purpose than its ability to stay in the air. Commercial aviation in those days consisted almost entirely of exhibitions at county fairs and air meets.

The World War brought about a very rapid development in military aircraft and with it a general knowledge of construction and design which later contributed greatly to commercial aircraft. Up to as late as 1925, however, commercial aviation hardly existed. There were passenger air lines operating in Europe, mostly under government subsidy, and our own government had developed the transcontinental air mail to a two-business day service across the United States. These were the outstanding examples of commercial flying five years ago.

Meanwhile the increasing aërodynamic knowledge, together with better structural design and improved power plants, reached a point where it began to be possible to build aircraft which could operate with sufficient safety and economy to be independent of outside subsidy. Then began the real development of commercial aviation. The end of the first quarter of the twentieth century marked a mutation in the history of aviation.

Today it is probably in the most awkward period of its existence. Branches of the industry have jumped far ahead of their proper position. Others are as far behind. Growth has been so rapid that an unbalanced situation exists. For a period there was an excess of trained pilots and a shortage of planes for them to fly. A year later there was a scarcity of trained pilots. Today there is undoubtedly a great market for a modern inexpensive airplane, but not enough demand for our present more expensive products to create the high production which would bring down cost.

In fact, as far as commercial flying is concerned, we are now in a position very similar to that of the Wrights a few years after the flight at Kitty Hawk. Our development has hardly begun and improvements are coming so rapidly that in order to keep up we must change our equipment and methods almost as rapidly as they are established.

During the next five years we can look forward to overcoming almost completely many of the difficulties which now confront us. We will undoubtedly be moving twenty-four hours a day on our established air lines. Radio control and communication will go a long way toward permitting operation to continue safely through weather conditions which hold us on the ground today. Air schedules will be improved and it will be possible to reach almost any destination without using other means of transport. Passenger planes will become larger on the main lines and their cost of operation per passenger will be greatly reduced.

We can look forward to much higher speeds than we have at present. More efficient engines, reduced structural weight, and better aërodynamic design will all contribute and the possibilities of high altitude flying are as yet practically untouched.

Instrument Flying

Aviation, May 10.—Modern minds attach much greater importance to nomenclature than did Shakespeare, and feel that the query "What's in a name?" is not to be lightly answered. The Boeing Company, for example, insists that "blind" flying is a misnomer when applied to flying by instruments, and have abandoned the use of the term. If a pilot feels the helplessness that the idea of blindness conveys to the person of normal vision, they say, he had better descend forthwith. "Instrument" flying is, however, receiving an increasing amount of attention, students in the schools being trained to fly in hooded cockpits for long distances and over triangular or other irregular courses. The same practice has of course been extensively adopted elsewhere, especially by transport lines seeking to put a super-finish on the qualifications of their own personnel.

Pilots who have not been trained to depend on instruments are prone to become panicky after a few minutes without seeing their course. Those with only a limited

experience find the nervous strain of long-continued instrument flying terrific. There are well-trained and reliable pilots of the older generation who still insist that no one can fly solely by instruments for more than five or ten minutes without losing his nerve. Yet young students are learning to fly prolonged and irregular courses entirely by instruments in hooded cockpits, and navigating with remarkable accurracy.

Colonel Lindbergh is reported to have said that one of the hardest things about his New York to Paris flight was to believe that the instruments were right when his personal feeling was that they must be wrong. Other pilots innumerable have told the same story. Navigators of long flights tell of the tendency of even the most experienced pilots of the older school to seek visibility, even at dangerously low altitudes, rather than fly through fog or clouds for even a few minutes. And there is little doubt that some of the regrettable transport accidents might have been avoided had the pilots of the planes been thoroughly trained in flying by instrumental guidance alone.

Dependence on instruments, however, places an ever-increasing responsibility on both the instrument manufacturers and on those who select the equipment. On the former to design and build instruments of the greatest accurracy and reliability. On the latter to select the best instruments obtainable. Only reliable products by makers with a reputation to sustain should be considered, and if the price is somewhat higher than for some alternative product it is a cheap form of insurance. Safety is at stake in the development and use of the most efficient, most reliable, and sturdiest aërial navigating equipment available.

The Air Weapon

Army, Navy and Air Force Gazette, May 1.—Since the debate on Lord Trenchard's motion in the House of Lords on April 9, there has been much fruitful discussion on the functions of the air weapon in war and peace. This is all to the good, especially in view of the danger of apathy with which, as Sir Samuel Hoare has pointed out, all the services are at present faced. The need for reviving and stimulating interest in the progress of the air weapon becomes apparent with striking force when the question of relative strength is considered. Whatever else the Royal Air Force has to do, it can hardly be disputed that it must be looked to for the defence of these islands against air attack in any great war of the future. That is a serious responsibility, and any estimate of the means likely to be required for its discharge involves a consideration of the air forces of other European powers. Such a consideration gives cause for some concern, in the light of the figures of relative strength given by Mr. Montague in a written reply to Sir Samuel Hoare on April 16. The approximate number of first-line airplanes maintained by this country at present is 780, which is little more than half that of France (1,310), and one-third less than that of Italy (1,100). Whereas those powers have increased their air expenditure by 140 per cent and 31 per cent respectively since 1925, Great Britain's expenditure shows a decline of 2 per cent. If we were to follow the United States' lead in naval affairs, we should start a movement for parity in aircraft strength because then we should be the strongest.

Lord Beatty and the Royal Air Force

Army, Navy and Air Force Gazette, May 8.—Twelve years have now passed since the Royal Air Force was organized as a service independent of the Army and the Royal Navy. It was born of war and of the muddles of war, and there were many critics of the scheme when it was first announced. In the years immediately following the war there were many determined attempts to destroy the new structure and to restore to the Army and the Navy their respective air arms. These attempts were defeated and the air officer chiefly responsible for the defeat was Sir Hugh, now Lord, Trenchard. The Royal Air Force is now firmly established, and it is strange that Admiral of the Fleet Earl Beatty should in these present times attempt to revive an old controversy and to retrace historic steps. The opportunity was given him by Lord Trenchard, who, on April 9, opened a debate in the House of Lords on the function of the air weapon. Lord Trenchard's intention was to induce the government to consider the uses of the Royal Air Force in relief of the older services in various parts of the empire. He suggested that

air force units might be employed in substitution for Army and Navy units in certain places to be selected. By this means there would be increased economy in military affairs. It was natural that there should be some disagreement with his view, but Lord Beatty alone has seized the opportunity to suggest a return to old schemes, supporting his arguments with open attacks on the youngest service.

In a letter to *The Times* he said that the "Navy today is the most up-to-date and efficient Navy in the world, except in one respect, and that is in air equipment. The air wing of the U. S. Navy, owing to the single control exercised over the U. S. Navy, is far ahead of our Fleet Air Arm. They carry out exercises on a scale quite impossible in our fleet. Coöperation between their ship-borne and shore-based aircraft has reached a high state of efficiency; with us it is nonexistent." Where did Lord Beatty make these discoveries? Is it possible that during his period of service as first sea lord he knew very little of the work done by the Fleet Air Arm? Efficiency cannot be estimated in terms of numbers. One nation may possess an air arm of 100 machines and its neighbor possess one of 1,000 machines, but the smaller force may be the more efficient. Lord Beatty need not be anxious about the efficiency of the Royal Air Force. There is no more efficient air arm or air force in the world. It is curious that he should speak of the United States naval air service, as in that service there is a mass of grumbling which bears close resemblance to that common in the Royal Naval Air Service. United States naval pilots complain that they are neglected by the Navy Department and that the older naval officers have little sympathy with the new weapon. Many of these air service officers would like to bring about the formation of an independent United States air force. Later in his letter he said that "We are the highest-taxed country in the world, and yet we commit ourselves to the extravagance of having three fighting services. Reduce them to two and we should save millions of public money with greater efficiency, as in the United States." Lord Beatty should have supplied figures. A return to the two-service system would not save "millions of public money." The greater strength of the two United States air arms is due to the much greater expenditure authorized by Congress. If we are to follow the United States it will mean a vast increase in expenditure, an increase which would not be authorized by the House of Commons while the national finances are in the present serious condition.

There is one other strange passage in Lord Beatty's letter. He said that "A military force equipped with air weapons, although commanded by an R.A.F. officer, exercises military control and not air control." But surely an admiral commanding a fleet at sea is also exercising military control? All warlike operations are military operations.

Whatever may be our personal views, it is now too late for a reversion to the old system. The Royal Air Force has come to stay—unless indeed the three services vanish in favor of one, which is unlikely. The Royal Air Force has justified itself, and should be left free from criticism which is purely destructive. There was a time when Lord Beatty was in a position to further the cause of the Royal Naval Air Service. There is no indication that at that time he had the belief in air power which he now shows in his letters.

MISCELLANEOUS

The Zeiss Planetarium

Tech Engineering News, May.—Astronomy, because of the complexity of the subject, has been one of the things which it has always been difficult to teach. In the past, in order to explain the movements of the planets around the sun, attempts have been made with varying degrees of success to build mechanical models. One of the first of these was one constructed by Charles Boyle, fourth Earl of Orrery (1616-1731), who built a very complex model in which the planets were represented by spheres of various sizes supported on a movable framework and driven along their paths by mechanical means. Although this type of model did have merit in helping to explain the workings of the heavenly bodies, it had the demerits of having the mechanical parts very much in evidence, which destroyed the effect and was very cumbersome and difficult to build showing many of the heavenly bodies.

The Zeiss planetarium is built upon an entirely different principle. Instead of the observer being placed in a position in outer space, he is on the interior of a large hemisphere made to represent the heavens, his position being similar to that of an observer upon the earth's surface. Instead of using mechanical models of the stars and planets, representations of them are projected from the large planetarium instrument placed in the center of the floor. This instrument consists of two semi-spherical star-image carriers, one for the southern and the other for the northern hemisphere, placed at opposite ends of the instrument. Between these carriers is a section of the cylindrical framework for projecting the bodies of the solar system. Lenses and light sources, together with film in some cases, provide the means of projecting the images of the heavenly bodies upon the large dome of the planetarium. The apparatus which thus throws lantern slide images of stars upon the dome is very complex, 119 optical projectors being required to reproduce every possible motion in a celestial body. There are 16 for the fixed stars of the northern sky; 16 for the fixed stars of the southern sky; 18 for the nebulæ, star clusters, and Sirius; 10 for the sun, moon, and Saturn; 8 for Mars and Jupiter; 12 for a network of lines which includes the zodiac, the polar circles, and the ecliptic; and others to indicate names and to serve various additional purposes. Besides these there are three electric motors alone for controlling the length of the year, while others mimic the nutation of the earth and vary geographical latitude.

One can imagine the complexity of this instrument when it is realized that in its final form every single star which on a clear night is visible to the unaided eye is so accurately shown within so close a distance of its actual relative position on the dome, that it would be necessary to take actual astronomical observations by means of instruments to reveal any error. Through nearly 9,000 stars, the sun, the moon, and the planets move along paths which are so nearly correct that the maximum possible deviation in the orbit of any one of the planets for a period corresponding to 5,000 years would be only one degree. One of the chief values of such an artificial representation of the heavens is the manner in which events which take place in nature with extreme slowness can be speeded up so that instead they can be made to take place within a very few hours, minutes, or seconds. Thus it is possible to show the diurnal movement, by which the heavens once in every twenty-four hours appear to revolve about the earth, within a period of four minutes or in one and one-quarter minutes. For studying the motions of the planets, a whole year may be made to take place in four minutes, in one and one-quarter minutes, or in seven and one-half seconds. It is possible to speed up events still further so as to show the heavenly vault as it will appear ten or twenty thousand years from now, at which time it will be rotating about a different pole star. A quick precession drive allows this to be done carrying the pole of the heavens once around its 26,000-year cycle in one and one-half minutes.

Courtesy Carl Zeiss

CROSS-SECTIONAL VIEW OF THE INTERIOR OF THE PLANETARIUM

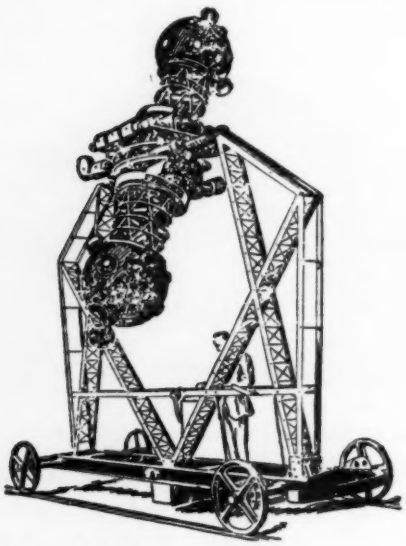
The lecturer is pointing out the stars and planets by means of a flashlight.

Not only is it possible to change the time in which events take place in the heavens, but it is also possible to show the spectator how the heavens would appear to stargazers on other parts of the earth's surface. They can be transported to the tropics and shown constellations which they have never seen, or they can be taken to either pole where the celestial bodies simply swing around forever in circles without rising or setting. Thus it can be seen that in a modern planetarium any star can be shown as it appears at any time from any part of the earth.

In reproducing the Milky Way, more trouble was experienced than in the entire problem of fixed-star projection, due to the difficulty in finding a satisfactory image.

The Milky Way is composed of areas which have varying degrees of light intensities.

In reproducing the Milky Way a pattern of dots was arranged on concentric circles laid out by draftsmen on a large scale. This same pattern was then repeated ten times, each time using dots of a larger size, thus giving ten patterns of as many graduated degrees of "darkness." Negative prints made on a reduced scale were then made from each pattern, these prints showing white spots on a black background, in ten different degrees of "lightness." By cutting out sections of the required shape from a number of such prints and pasting them together on a board in an arrangement corresponding to the map, an accurate large scale original was obtained. All that was then needed was a photographic reduction to the proper size to yield the film.



Courtesy Carl Zeiss

THE ZEISS PLANETARIUM INSTRUMENT

It projects the images of the stars and planets upon the planetarium dome.

The planetarium instrument is controlled by a lecturer. A spectator takes his seat beneath the dome with six hundred others. As the lights are gradually turned down, the white ceiling above loses its whiteness and his eyes become gradually accustomed to the darkness. When a switch is thrown, the vault becomes studded with stars, and he finds himself out of doors, beneath a firmament of twinkling stars. The lecturer controls the instrument from his desk and points out the various stars and planets to the spectators with the aid of a flashlight which flashes an arrow on the dome. He shows them why Venus appears only as a morning or evening star, and is never seen at midnight because Venus circles around the sun within the orbit of the earth. Dr. Bauerfield, the engineer who designed the planetarium, has succeeded so well that the effects correspond exactly with those of nature. The heavens within the planetarium appear a faint blue, the same phenomenon which is observed out of doors on a clear night. Care has been taken that as the star sets, it becomes fainter, even as it does in reality, due to the thicker layer of air through which its light must pass.

In building the structure of the dome itself for the Munich planetarium, the attempt was made to have it made with the least possible expenditure for material and wages. A network dome was constructed of iron rods of varying lengths joined together by means of girder locks. When the network was completed, the inner surface was covered with a temporary wooden sheathing, against which concrete was sprayed. For insulation purposes cork sheets were used to cover the dome, and over these rubber sheets for roof covering. For the Munich instrument the entire thickness of the finished dome covering, including the insulating layer, is only 1-250th part of the dome's diameter. The ratio of the thickness of the shell of the dome to its diameter is therefore less than that of the eggshell to the diameter of a hen's egg.

However, a concrete lined dome has very poor acoustical properties due to sound waves from the speaker being reflected from the hard walls, and because of the shape of the dome coming to a focus again, after the lapse of a short time interval. To remedy that in later constructions, an inner dome was constructed inside of the outer concrete one, and this inner one was covered with white linen which allowed the sound waves to pass through it easily. Between the two domes were placed a large number of thin metal plates, set at varying angles so that the sound waves passing through were diverted in different directions, and did not come to a focus again.

NOTES ON INTERNATIONAL AFFAIRS

From May 4 to June 3

Prepared by Professor Allan Westcott, U. S. Naval Academy

LONDON NAVAL TREATY

Extra Session for Treaty.—In view of the extended time taken for hearings in the naval treaty before the Senate committee on foreign affairs, it was decided that final consideration of the treaty by the Senate should be postponed to a special session, to be called immediately after the adjournment of Congress about the middle of June. Estimates varied from a week to a month as to the time that would be required for its consideration in the special session, and in view of the increasing opposition to the treaty there appeared even a possibility that a final vote might be postponed till the regular session in December.

Testimony of naval officers called before the Senate naval and foreign affairs committees was in fairly general agreement that the restriction of a large part of American cruiser tonnage to 6-inch gun ships was disadvantageous, and that under the terms of the treaty the United States would have somewhat less than the 5-5-3 ratio in all auxiliary classes. The hearings of the foreign affairs committee closed on May 28, but several days were spent subsequently in study of confidential correspondence between the London delegates and the State and Navy Departments during the negotiations. Testifying in favor of the treaty at the opening of the hearings, Secretary Stimson as head of the American delegation declared that the agreement gave actual and technical parity with England, that "neither party over-traded the other," and that "on every major question at London unanimous agreement was reached among the members of our delegation."

Japaneses Attitude toward Treaty.—In view of the favorable terms gained by Japan in the London treaty it was believed there would be little difficulty in securing its final ratification by the Privy Council. Some possibility of a cabinet upset arose, however, when it announced on May 30 that Admiral Takarabe, Minister of the Navy, had reversed his attitude and given support to Admiral Kato, Chief of the Naval Staff, in his contention that the government should have secured the approval of the staff before accepting the treaty.

EUROPEAN POLITICS

Pan-Europe Proposal.—The scheme of Foreign Minister Briand of France for a "European Federal Union," or regional compact somewhat on the lines of the Pan-American Union, suggested last year, was formally presented on May 17 in a memorandum to twenty-six European states, already members of the League of Nations, which had agreed to consider the plan. All that M. Briand calls for at present is preliminary criticism and comment on the proposal, with a view to its further discussion during the League Assembly next September.

The plan proposes two bodies: a European conference to meet annually at Geneva, somewhat corresponding to the League Assembly; and a European commission, somewhat like the League Council. The president of the union would be drawn from each member state in rotation. It is one of the fundamental conditions of the union that it shall work in harmony with

the League of Nations and in opposition to no other group of powers. While the memorandum points out many fields in which coöperation among European states may be beneficial, its chief opportunity for service would be in removing trade barriers and bringing the European nations into closer economic union.

The European press received the plan favorably but coolly, with many doubts as to its immediate possibilities, especially in view of the bellicose utterances of Premier Mussolini in his speech at Leghorn, almost coincident with M. Briand's proposal. Both in Italy and Soviet Russia the plan was greeted with derision.

League Council Session.—The session of the League of Nations Council at Geneva, May 12-15, managed as usual to postpone all matters threatening serious controversy. One of these troublesome problems was the complaint of Jugoslav against the activities of the Macedonian comitatje, or secret political society, in stirring up trouble along her Bulgarian frontier. The Jugoslav Foreign Minister distinguished between the activities of the society and the Bulgarian government, but declared his intention, unless conditions were improved, to bring the matter formally before the Council in September, and that in the meantime his country could not consent to any amendment of Article XII of the Covenant which would prevent League members from resort to war. A second demand which may cause future trouble is the insistence of China that she be accorded a permanent seat in the Council. Before ending its session the Council appointed a special commission to study the dispute between Arabs and Jews over the Wailing Wall in Jerusalem.

Arms Session in November.—Shortly before the League Council session, President Loudon of the League Preparatory Commission for a Disarmament Conference announced that the next meeting of his commission would not be held until November 3. This will give time for ratification of the London treaty, and for further efforts on the part of France and Italy to come to a naval understanding. Meanwhile the prospect fades for a general disarmament conference before 1932.

The League Committee on Arbitration and Security held a meeting in May and took action in a number of matters which may be brought before the League Assembly in September. The committee adopted a resolution providing assurance for league aircraft communications in time of emergency, and agreed upon the phrasing of the convention designed to assure league financial aid to a nation, victim of aggression and willing to submit its grievance to mediation.

Franco-Italian Problems.—The chief effect of the League Council session at Geneva in May was to bring together Foreign Ministers Briand of France, Henderson of England, and Dino Grandi of Italy in informal conversations seeking out a plan of negotiations by which in the course of the summer Italy and France may work toward a settlement of the naval—and the underlying political—problems left unsolved at London. As very generally recognized, the friction between the two Latin nations is one of the chief discords in the present European concert, a discord by no means diminished by Premier Mussolini's saber-rattling speeches during his tour of Italian cities in May. In the colonial field there are two particular problems—the status of Italians in Tunis, and the dispute over the Sahara frontier of Tripoli—which call for settlement before the two nations are likely to reach any agreement in matters of armament.

International Finance.—The Board of Directors of the Bank for International Settlements held its first official meeting at Basle on May 12, at which plans were considered for the issue of the first $300,000,000 loan under the Young Plan, as well as the issue of the $100,000,000 shares of capital stock in the bank itself. These latter are to be sold in ten countries, including Holland, Switzerland, and Sweden, in addition to the seven nations originally concerned in the organization of the bank.

Meantime the Reparations Commission which had functioned under the Dawes Plan closed its activities and, through Agent General of Reparations Seymour Parker Gilbert, turned over to the new bank its credit balance of some $43,000,000; and the German government deposited with the bank a certificate acknowledging its total reparations indebtedness (figured under the

Young Plan at about 36,000,000,000 gold marks, or $8,640,000,000). Following this action, Premier Tardieu on May 17 issued final orders for progressive evacuation of the last French troops on German soil, to be completed by July.

The $300,000,000 reparations bonds, planned for issue about June 11, will bear 5½ per cent interest. Of the proceeds, $100,000 will be turned over to Germany for railway and postal improvements, and the remainder will be distributed among the creditor nations.

UNITED STATES AND LATIN AMERICA

AMERICAN IMMIGRATION RESTRICTIONS.—The amicable relations between the United States and Mexico established during Ambassador Morrow's service in the Mexican capital appear seriously threatened by the provisions of the new Harris-Box immigration bill now before Congress, which singles out Mexico as the only American country to be put on a quota basis, and restricts the Mexican allowance to less than 3,000 each year. Canada was originally coupled with Mexico under the quota, but the restriction in her case was subsequently removed.

In Japan, on the other hand, there was much satisfaction over the prospect that in the new bill Japan might be assigned a quota, which, even though extremely limited, would remove the stigma of complete exclusion.

REVOLT IN INDIA

CONTINUED VIOLENCE.—Throughout May riots and bloodshed figured prominently in news reports from India. Leaders of the Gandhi nationalist movement organized mob demonstrations and parades in the chief cities and almost daily raids on the government salt works at Darkama and Wadala, which led to innumerable arrests and fierce conflicts with the police. On May 27 riots in Bombay, Dacca, and elsewhere piled up a total of 82 dead and 100 injured. Earlier in the month the manufacturing town of Sholapur, 220 miles southeast of Bombay, was taken over by Gandhi followers after severe fighting and remained in their hands for several days until the city was reoccupied by a force of 1,000 Ulster Rifles. At Lucknow near the close of the month there was a thirty-six hour conflict between mob and police, which was ended only by the calling out of troops.

Although experts on Indian affairs held the opinion that the Gandhi propaganda had the support only of a minority of the more ignorant Hindus, constituting not more than a third of India's total population of 320,000,000, increasing evidence indicated that the movement was spreading among the mercantile and upper classes. A meeting of fifty Bombay merchant associations in May adopted resolutions demanding the release of Gandhi, the boycott of English goods, and refusal of Indian leaders to attend the round-table conference on Indian affairs set by the government for next October.

BRITISH POLICY IN INDIA.—Injury to British trade, and especially to the English manufacturing industry, led to sharp criticism of the government policy in Parliament, the attacks coming chiefly from the radical wing of the Labor party. Strong Conservative and Liberal support, however, was given the government in its attitude that the Indian troubles represented "sporadic anarchy" rather than general revolt, and that the government would carry out its duty of maintaining order by force. On May 12 the British Viceroy, Lord Irwin, formally announced that the government would hold to its plan of calling a round-table conference to begin on or about October 20, to which representatives of all Indian parties and races would be invited to attend. Meantime, despite the rapid changes in the Indian situation, interest still centered in the much-heralded report of the Simon Commission, the publication of which was set for June 10.

WEAKNESS OF GANDHI MOVEMENT.—Writing on "Mahatma Gandhi" in the *Times Current History* for June, Prof. W. H. Roberts closed with the following criticism of the Indian leader's outlook and aims:

> To one who attempts to view India's most pressing problems realistically rather than romantically, it seems clear that they are not political at all. Indians can best prove their rights to freedom not by orations in a national Congress in the style of Patrick Henry, but by grappling effectively with economic and social problems: poverty, famine, disease, sanitation, the improvement of agriculture, the guidance of the industrial revolution now taking shape in India, the caste system, early marriage, illiteracy, ignorance, superstition. For such leadership as India so desperately

needs, Gandhi is tragically unfitted. It is tragic, because he is so nearly his people's savior; but he is unable to take a realistic view of the situation. He is in revolt against the great impersonal economic and industrial tides that are slowly but irresistibly flooding India and transforming it. If Gandhi could understand the importance of the economic and industrial development of his people; if he could realize that only as they become economically stable and sound, intellectually emancipated and united through long coöperation in common practical tasks, can they deserve freedom or use it rightly; if, in short, he were content to build for the ages, he would be even greater than he is.

ENGLAND AND THE EMPIRES

DRIFT TOWARD PROTECTION.—In view of England's serious trade and unemployment problems, there was increasing evidence during May that even within the Labor party the policy of building up the economic unity of the empire by protective and preferential tariffs will find increasing support. During the month the economic council of the Trade Union Congress closely affiliated with the Labor party, reported strongly in favor of a policy of empire trade unity. On this issue in the Nottingham by-election of May 27 the Conservative candidate won by an increased majority. In a lecture printed in the May issue of the *Journal of the Royal United Service Institution,* the chairman of the Imperial Shipping and Imperial Economic committees, Sir Halford Mackinder, reviewed clearly the problems to be solved in bringing about closer economic coöperation between the parts of the empire. Pointing out that the empire at present has a trade with the outer world between two and three times as great as the domestic trade between the parts of the empire, he closed as follows: "I believe, therefore, that the most important thing for us at the present time . . . . is to create the necessary machinery for imperial economic coöperation."

ANGLO-EGYPTIAN PACT FAILS.—Five weeks of negotiation for a new Anglo-Egyptian treaty ended on May 8 in failure to reach an agreement. In general the British concessions did not go greatly beyond those offered in the draft agreement of last August—removal of British troops except in the Suez Canal zone, complete abolishment of extraterritoriality, exchange of ambassadors, and support for Egypt's admission to the League of Nations. The present negotiations failed chiefly owing to England's refusal to grant the Egyptian demand for complete parity of civil and military administration in the Sudan.

FAR EAST

THE WAR AGAINST NANKING.—Hostilities between the Nanking government and the Northern alliance of Yen Hsi-shan and Feng Yuhsiang opened on May 8 with a series of engagements in northern Honan province and along the Lunghai railway. These continued through May without decisive victory for either side, though at the close of the month the campaign appeared to be turning in favor of the Northern Coalition, with reports of a decisive defeat of the Nanking army and capture of some 50,000 prisoners. President Chiang Kai-shek went to the front early in May to assume general command of the Southern forces.

In its northern campaign the Nanking government was greatly handicapped, not only by serious financial difficulties but by the operations of great numbers of bandit and so-called communist forces almost throughout the southern and central provinces. At the close of the month bandit troops were attacking the city of Changchow, thirty miles west of Amoy in Fukien province, and the city of Kangchow was also besieged by outlaw forces. In the existing lawlessness, English and Americans in Honan, Hupei, and Kiangsi provinces were advised at the end of May to withdraw to Hangkow and other places of safety.

TIENTSIN CUSTOMS REVENUE SEIZED.—In addition to taking over complete political control in Peking, Governor Yen Hsi-shan early in May issued a mandate that all customs revenues at the port of Tientsin above 5 per cent (which was left for payments on foreign loans) should be held subject to his orders. The effect of this very natural move was to shift a revenue of at least $5,000,000 from the Southern to the Northern treasury.

BOOK DEPARTMENT

Members of the Institute may save money by ordering books through its Book Department, which will supply any obtainable book. A discount of 10 per cent is allowed on books published by the Institute, and 5 per cent on books of other publishers (government publications excepted). Address Secretary-Treasurer, U. S. Naval Institute, Annapolis, Maryland.

THE PARIS GUN. By Lieutenant Colonel Henry W. Miller, Ordnance. New York: Jonathan Cape and Harrison Smith. 1930. $3.75.

REVIEWED BY LIEUTENANT E. E. HERRMANN, *U. S. Navy*

With the World War as much as a dozen years behind us, there still remain some features of that struggle that are enshrouded in mystery for most of us. Few events of the war created greater popular interest and speculation throughout the entire world than the long-range bombardment of Paris by the Germans in 1918, and yet one finds even at this late date that little is known, in the world at large, of the particulars of this military operation and of its specific purpose. In *The Paris Gun,* Lieutenant Colonel Miller offers an excellent narrative covering that portion of the operations of the World War of which the long-range bombardment of Paris formed an important part.

The title of the book, although it serves to incite the interest of those who have been curious about the German super-gun, hardly does justice to the scope of the work of its author. Far from being confined to a technical description of the Paris gun, the book covers one of the most critical periods of the war. It deals with the great German offensive of 1918, and just as the Paris gun played a spectacular part in that offensive, so does Lieutenant Colonel Miller let it play that rôle in his narrative. The soundness of the decision of the Germans to employ this unorthodox method of warfare, may long be questioned; it is regarded by some as belonging to the same category as unrestricted submarine warfare. But when viewed against the background of the general plan of which it was a part, the Paris gun appears, at least, not to have been designed merely as an engine of frightfulness, to visit the ravages of war upon noncombatants solely for the sake of spreading general terror. Had this been the design of the Germans, the gun might have been so employed before it was actually brought into action. The real strategy was somewhat deeper. The spring drive of 1918 was the Germans' last resort. They realized that the war had to be won then or not at all, that neither their strength nor their spirit could survive the material and psychological aid that the addition of America's weight, to that of the Allies must soon bring. On the other hand, the stage was particularly well set on the German side. The liberation of her armies from the Eastern front had given her the necessary surplus with which to apply a crushing blow against the seriously depleted forces of the Allies on the Western front.

The German plan of 1918 contemplated the execution of a series of offensives, directed at various points along the Western front and designed to demoralize the enemy and disorganize his forces. With their surplus of reserves, it was possible for the Germans to concentrate superior forces almost at will, without weakening their own front

line. They realized that the Allies, pressed to keep even their front line secure, could concentrate only at the expense of weakening their line at some point. The aim of the Germans was to drive repeatedly at the weakened spots and ultimately to bring Paris under siege.

The very existence of the long-range gun was kept a closely guarded secret until the offensive had gotten under way. It was not without significance that the Germans waited two days after the offensive had started, before opening fire with the gun. In the meantime, the alarming news that the German armies were making large gains toward Paris had reached that city. This was the psychological moment for which the gun had been reserved. A much-dreaded offensive had started; such news as filtered through the rigid censorship was most disquieting and pointed to serious reverses for the Allies; and then Paris was subjected to actual shell fire. When one considers that even artillerists were amazed at the feat, one can comprehend that the inhabitants of Paris were brought to the verge of panic by the fear that the enemy was at their very gates. That wholesale panic and demoralization were averted may, perhaps, best be explained by the fact that Paris had already for three years been subjected to air raids, and had steeled its nerves against this warfare which struck within its walls. After it became generally known that the bombardment was from such a great distance, the populace learned to put up with it much as it had learned to put up with the air raids.

The incidents surrounding the bursting of the first shells in Paris, the bewilderment of the authorities, the activities of the defense organization in determining the nature and location of the new menace, the measures taken to avert panic and to provide protection against the bombardment, the establishment of counterbatteries—all of these are recited dramatically in *The Paris Gun.* The recital is the more vivid because the author surrounds it with all the bewilderment and speculation that actually attended the events, and the reader can readily appreciate the state of mind of the Parisian who, that twenty-third of March, as at a loss to know whether the enemy had actually laid siege to his city, or whether an air raid was being conducted from such a height that the bombers were invisible, or whether mutinous French troops had turned against their own capital.

Of technical detail, there is little to weary the lay reader. It is apparent that the author has deliberately avoided discussing the Paris gun from the viewpoint of the artillerist. He mentions such outstanding features as the general dimensions of the gun, its velocity, dimensions of the projectile, powder charge, pressures, as well as unusual features of the trajectory. He outlines, in general terms, some of the unusual problems encountered in controlling the gun, due chiefly to its exceedingly rapid erosion. The only form of spotting that could be done with this gun was to measure the bore pressure for each round, calculate the resulting velocity, and thence determine the range for the shot. No attempt was made to select individual targets within the city; the gun was laid at exactly 50° elevation for each shot and the weight of charge was adjusted for each shot so as to give the velocity required for the range to the center of the city. Bore enlargement was measured after each shot, by noting the advancement in seating of the projectile; some conception of the erosion may be gained from the fact that in about sixty rounds, the bore enlargement at the origin was great enough to cause the projectile to seat six feet farther forward than it had seated for the first round, or, in other words, the length of its powder chamber had increased six feet. The elevation of 50° was selected because it drove the projectile rapidly into the rarefied atmosphere. At an altitude of about twelve miles it encountered practically no air; at this altitude the inclination of the trajectory became 45°, so that the projectile entered a virtual vacuum with the angle of departure for maximum range. It traversed about fifty miles in this near vacuum, reaching an altitude of about twenty-four miles. Some of the shots exceeded eighty miles in range. Considering all this, it is remarkable that even so large a target as Paris was hit consistently. Most of the shots fell within the city proper. The extreme pattern measured about twenty miles in range by nine miles in deflection, but eliminating a comparatively small number of straggling shots, the pattern was about ten miles by three miles. The mean point of impact was

about one and one-half or two miles from the center of the city. Lieutenant Colonel Miller gives charts that show the locations of all the shots that fell in and around Paris, 367 in all.

Features that are covered in some detail by the author are the preparation of the gun emplacements, camouflaging of the positions, the installation of the bases and carriages, and the mounting of the gun itself. These were engineering feats comparable to the design and operation of the gun itself, and are well worth studying.

A point in Lieutenant Colonel Miller's book, that should not escape attention, is the very convincing manner in which he points out how the active participation of the American forces, at a time when the Allied command considered them hardly prepared for such a rôle, served to turn the tide of battle at a crucial stage. Their relatively small part in the great defensive of the Allies served to break the heart of the enemy—the breaking of his back later on was perhaps less consequential.

HISTORY OF EXPLOSIONS ON WHICH THE AMERICAN TABLE OF DISTANCES WAS BASED, INCLUDING OTHER EXPLOSIONS OF LARGE QUANTITIES OF EXPLOSIVES. Compiled by Ralph Assheton and published under the direction of the Institute of Makers of Explosives, 103 Park Ave., New York City. 1930. $5.25.

Reviewed by Commander Garret L. Schuyler, *U. S. Navy*

The American Table of Distances (ATD) specifies minimum distances from inhabited buildings, passenger railroads, and highways at which the Institute of Makers of Explosives considers various quantities of explosives should be kept. It is the most authoritative expression of American opinion on these matters, and has been incorporated in the laws of many states. It was derived about twenty years ago from all pertinent data then available, and its utility is incontestable.

Mr. Assheton for each of the about 120 explosions on which the ATD was based, and also for each of about 20 more recent explosions of important size, has given brief descriptions averaging a little over two pages apiece, often accompanied by maps. Data are conveniently arranged and summarized in each individual history; and there is a good index. Histories of the explosions on which the ATD was based are arranged in increasing order of severity.

On page 298 Mr. Assheton states he includes the Oppau disaster "in spite of the fact that, though the chemical involved was not believed to be explosive, it behaved in such a manner as to be of interest." Reading further, we learn the "interesting results" included a crater 400 feet in diameter and 90 feet deep and a list of about one thousand persons killed! Manifestly the book deals with a subject sufficiently dramatic but, necessarily as with all good "source-books," it will be dull for all except a limited number of vitally interested readers.

Those experienced in deriving empirical laws, can appreciate that this series of data had to be considered in its entirety without undue emphasis on isolated examples, and that judgment had to be used in "fairing" relationships. Different groups of individuals could (within limits) interpret the figures differently.

Considering its make-up, and considering the amount of study put in by the board which formulated the ATD, it seems unlikely, however, that at this stage others can make important improvements. This then raises the question of why it seemed advisable to go to the trouble of making these detailed histories generally available so many years later. Perhaps it was not convenient to do so earlier, and perhaps it was desired to preserve the data for future use if the ATD is some day to be amplified. But if this is the reason for the book, the notes of the original board (which must somewhere be available) would have been considerably more valuable. Such original notes could clear up many doubtful points on how the board worked. Among other things, they would show whether the board used only straight plotting, or plotted and faired the *logarithms* of the two variables. The latter method undoubtedly would have been better but, from Mr. Assheton's foreword, it is surmised it was not used. Probably, however, the book's main purpose is simply to improve the "background" of those who deal with this code, and to make its data seem more convincing and real to

them than if they had only a curve or a table.

Naval officers at ammunition depots will do well to read the book from cover to cover, for probably in no other way can they so conveniently picture the results of large-scale explosive disasters and learn the general type of blunders or "hard luck" which caused most of them and will in future cause others.

The ATD permits putting the same weight of explosives closer to a railroad than to an inhabited house, and closer to a highway than to a railroad. Individual histories show these "safe" distances considerably exceeded by distances to which missiles were thrown and glass broken. Obviously the ATD figures do not limit the zone of damage suits.

Radii of *absolute* safety, however, would be so large as generally to be impracticable, and hence much less valuable than the ATD figures. Distances given by the table must be viewed simply as establishing limits beyond which the damage will be relatively so small that, if necessary, it can be safely underwritten like any standardized risk.

As military considerations argue against the risk of losing too great a percentage of the total stock in any one building, government explosive storage has tended towards numerous groups of small units. But simply from the viewpoint of safety to surroundings, the ATD figures clearly show that the safe "storage area per pound of explosives" is least with the largest size units. However, in industrial storages where the above-mentioned military consideration does not necessarily obtain, the law peculiarly limits the maximum size of unit without giving any reason.

Distances for Army and Navy explosive depots on shore are covered in detail in House Document No. 199 (70th Congress).

AIR POWER AND THE CITIES. By J. M. Spaight. London, New York, Toronto: Longmans, Green and Co. 1930. $6.00.

REVIEWED BY CAPTAIN E. J. KING, *U. S. Navy*

The author has produced a book which is important not only in regard to air power itself but is of vital moment in any considered study of war in general.

The matter of indiscriminate bombing of cities is thoroughly examined. The major premises for this examination are of particular interest to naval officers, being the theory and practice of naval bombardment (with details of thirteen actual cases that occurred between 1854 and 1916). The minor premises comprise studies of bombings which occurred during the years 1914-18.

The author, quite consistently and logically, arrives at the considered conclusion that indiscriminate ruthlessness in the bombing of cities is no more to be expected in the future than similar action has occurred in the past in naval bombardments.

The true objectives are considered to be works of military importance, not fortifications, camps, and dumps alone but munition plants, railway centers, etc. The peo- of a country can be expected to stiffen r resistance, in the future as in the past, ..ever ruthlessness and frightfulness have been employed.

The author then proceeds to develop the theory that air power can and should be applied to the extinction of war, in that bombing can be directly and immediately aimed at munitions plants of all kinds and, consequently, that the enemy thus effectively disarmed is bound to yield.

He also foresees the eventual creation of an international air force which, by destruction of the munitions plants of any recalcitrant power, will speedily cause it to comply with the dictates of international comity.

The book is worthy of close study and consideration.

FLAG IN THE WIND. By Alfred Stanford. New York: William Morrow and Co. 1930. $2.50.

REVIEWED BY INSTRUCTOR RICHARD S. WEST, JR., *U. S. Naval Academy*

Flag in the Wind is as juvenile a book as *Paul et Virginie* and the events recorded are equally as sweet, preposterous, and impossible. Andy Outen's flare for the sea takes him out of the stuffy New York office of a marine insurance concern to the great open spaces. He has learned of the numerous wrecks of coastwise craft near Gifford's Harbor, some miles from Boston, and has decided to try his hand at a salvage

job. On his way out he falls in with Franchelle, pretty waitress in a restaurant, who shares his desire for the open. Together the two build a hut, wait for a wreck, and then, when the insurance company has abandoned it, their uncanny engineering ability enables them to float the craft and ride merrily off on the crest of a storm. Pretty, very pretty.

However, Mr. Stanford paints a few strokes that could never have come from the brush of M. de Saint-Pierre. On one occasion for instance the author gets Andy roaring drunk—on cider and raisins!—and makes him stagger through the starched little New England town cursing and quarreling and climaxing his petty orgy by the theft of a carpet from a deserted meeting house. Much of the author's description is immature and flat, and his attempt at a thriller does not succeed.

GREAT NAVIGATORS AND DISCOVERERS. By J. A. Brendon. New York: Harcourt, Brace and Company, Inc. 1930. $2.50.

REVIEWED BY INSTRUCTOR RICHARD S. WEST, JR., *U. S. Naval Academy*

In *Great Navigators and Discoverers* J. A. Brendon outlines the lives of twenty-four naval celebrities from Leif Ericsson to Sir John Franklin. Obviously, in the scope of 270 pages the author can do little more than suggest the historic importance of these men and retail information which is in most cases extremely elementary. The minor figures, however, might serve to recommend the book to those interested in naval history. The reader to whom Jacques Cartier, Abel Janssen Tasman, Sir Henry Morgan, William Dampier, and William Bligh are little more than names might here find enough concise, accurate, and chatty information for a first acquaintance. The account of Sir Henry Morgan, the merry buccaneer of the Caribbean, is even spirited.

Mr. Brendon makes considerable use of quotations from early narratives, and supplements his brief accounts with a wealth of illustrations. Those who have not had access to the pages of Richard Hakluyt or Samuel Purchase might indeed find much miscellaneous information of interest.

FROM THE MISSISSIPPI TO THE SEA. By Rear Admiral Robert E. Coontz, U. S. Navy (Retired). Philadelphia: Dorrence and Co. 1930. $4.50.

REVIEWED BY CAPTAIN G. J. ROWCLIFF, *U. S. Navy*

A great many years ago an astute and experienced friend asked what a naval officer might consider to be the reasonable consummation of a career in the service; and the friend went on to remark that perhaps one who had attained the command of one of those "fine, large ships" would have no reason to feel disappointed. It may be assumed that this is the least to which an ambitious officer aspires. It may be taken for granted too that the hopes of many flourish, while those of others vanish, as the years pass. It is quite certain that for very few of those that start at the Naval Academy is there any great probability of achieving either the position of commander in chief of a fleet or that of chief of naval operations. But the mere operation of probability or percentage need not deter one from hoping and trying. Sustained hope and effort will make one a better officer, and may make the road easier, whether the goal be reached or not.

The probability that any officer may be both commander in chief and chief of naval operations before his career in the Navy terminates is so small that the story of how it can come about ought to be interesting to anyone interested in the Navy, or in people. The author of this volume enjoyed the unusual distinction and privilege of occupying both of these positions. Reading the book shows you the path by which he progressed from a small, and often barefooted, but always enterprising, boy in a small Missouri town during the period of reconstruction after the Civil War, to the two highest positions available in that branch of the federal service which he chose.

Perhaps you may think you have found the keynote on the first page—"This book is dedicated to the officers and men of the United States Navy." The personnel of the Navy is ultimately the Navy. To it must be dedicated your own personal service, and so quite appropriately therefore your book telling about it. The pages which follow the dedication add to this ideal the lessons of enterprise, common sense, and experience.

Every naval officer is sometimes asked what a naval officer does to occupy his time. For the civilian friend who has never been given an answer to this question, this autobiography gives a picture along broad lines. It will appear quite definitely that a naval officer may do a little of everything in almost any corner of the world. The book is rich in intimate accounts of personal experiences, told in an informal and easy style. The early pages of the book contain more detail than the later pages, for the rather obvious reasons that they refer to a more distant time and that the events are chiefly the personal affairs of the author. The story leads to events recounted in the later pages which are important and significant to the whole naval establishment. Perhaps it is a matter of regret that the author could not cover these events in more intimate detail for they doubtless would prove most instructive to younger officers as well as inherently interesting and enlightening. It may be hoped that a few of the later chapters of this book may be amplified some day.

The book is made readable by printing on a good kind of unglazed paper in acceptable type, and is illustrated by a few appropriate pictures ashore and afloat.

From the Mississippi to the Sea is recommended to those interested in the Navy of recent years and those interested in personal experience.

SALEM VESSELS AND THEIR VOYAGES. By George Granville Putnam. Series 4. Salem, Mass.: Essex Institute. 1930. $3.50.

REVIEWED BY CAPTAIN THOMAS G. FROTHINGHAM, *U. S. Reserve*

The history of the old time ships of Salem is an epitome of the early days of the American merchant marine, of the days when a voyage was indeed an adventure, and when sailors had to fight for their ships. This volume treats of the most hazardous of these ventures, as can be seen at once from the titles of its contents: The African Trade, the Madagascan Trade, the Feejee Island Trade, the South Sea Trade. In these true annals, from the collections of the Essex Institute, are sea tales more exciting than the prevalent output of stories and novels.

These records are of interest to all, but they make an especial appeal to anyone who has to do with the Navy, for they cover the formative period when the United States Navy was so closely affiliated with the merchant marine, and officers and sailors were interchangeable in men-o'-war and privateers. It is typical of this to find the first account is of the *America*, "perhaps the most famous ship of the place."

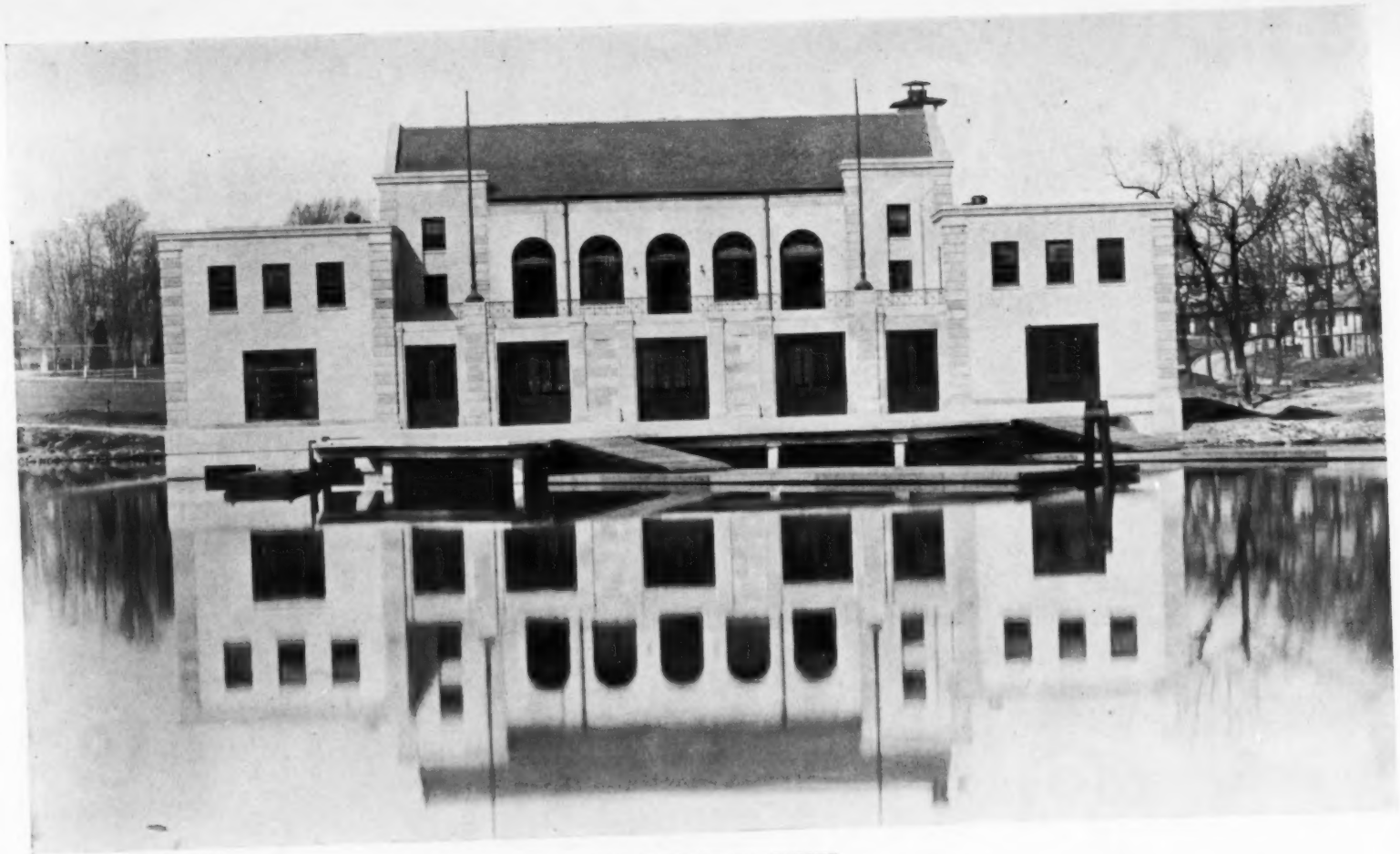
In the War of 1812, the ship *America* earned the right to be called "the largest, the fastest, the most fortunate, of all the privateers which sailed out of Salem Harbor." She sent into port prizes "of a value of $1,100,000"—a large total for those days.

The illustrations are reproductions of pictures of the old ships, and of portraits of their captains. It is only necessary to look at these last, to realize that the old captains were remarkable men. And they had need to be, for "cruisers, regardless of the law of nations, were roaming in all directions, gunboats out, and lateeners, luggers, corsairs, and pirates." It was a school to develop men of resource.

These intimate logs of their voyages showed that the Salem captains learned to become all things to all men. Of one of them it is stated that, in the Feejees, "he performed the first missionary service at the islands; for on one occasion, seizing a hatchet, he demolished an idol before them, at the same time preaching an impressive sermon!"

At Tahiti a Salem captain had driven off a war party of savages, by sweeping his deck with a cannon and using his dog to put the chief to flight. He told this to the missionaries, "which greatly surprised them, for they said that only a year before, in the very same place, an English ship had been boarded by this same war party, and all on board had been killed and eaten by the murderers." It is not a matter for wonder that it is said a Salem ship captain christened the American flag "Old Glory"!

The sea is in the blood of all Americans. In one generation or another we all came over the sea. Its heritage was proved in the World War by the 530,000 in the United States Navy—and all, whether drawn from the coast or inland, taking to water like repatriated ducks. To keep this sea spirit alive is the part of Americanization—and the Essex Institute is doing a great service in publishing these records of seafaring.



Pickering Studio, Annapolis

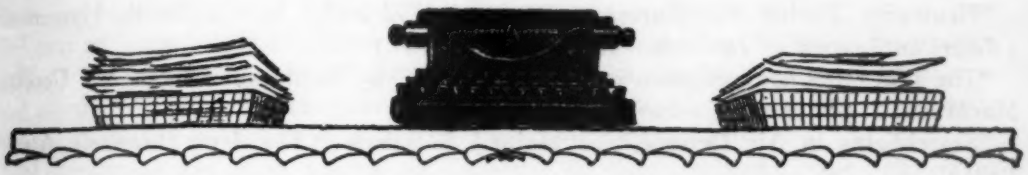
THE HUBBARD BOATHOUSE

The new boathouse at the Naval Academy just recently completed.

Pickering Studio, Annapolis

BRONZE REPLICA OF TECUMSEH PRESENTED BY THE CLASS OF 1891 TO THE NAVAL ACADEMY, JUNE, 1930

SECRETARY'S NOTES



Captain R. C. MacFall, Secretary-Treasurer of the Naval Institute since January 23, 1928, has been ordered to sea and assumed command of the U.S.S. *Dobbin* on June 11, 1930. The Board of Control accepted his resignation with sincere regret. The Secretary-Treasurer was instructed to enter in the minutes an expression of Captain MacFall's faithful coöperation with the Board and the very efficient manner in which he conducted the business, resulting in a continuation of the financial success of the Institute.

Change in Board of Control

At the last meeting of the Board of Control, held June 12, Captain E. J. King, U. S. Navy, and Commander Oscar Smith, U. S. Navy, submitted their resignations. The vacancies were filled by the appointments of Captains H. A. Baldridge and W. L. Friedell, U. S. Navy.

Naval treaty

The committees on Foreign Relations and on Naval Affairs completed hearings on the London Naval Conference. The differences of opinion between the executive and legislative departments of the government with respect to secret correspondence between this government and foreign governments which might have a bearing on the Senate action in consenting to any treaty has been freely discussed in the public press. The President refused to furnish correspondence and the Foreign Relations Committee placed itself on record as opposed to his action, stating it was their right to have access to such correspondence as a part of the treaty-making machinery of the government.

During the hearings, naval officers were called before the committees. The American people are entitled to their opinions. Some correspondents have attacked these officers for what they attempt to term the admirals' desire to increase naval armament. The Institute has repeatedly explained the relations existing between the responsibility of the statesmen and the so-called naval experts. When requested by proper authority, naval officers are required to give expert technical advice. The responsibility for policies rests with the statesmen. Congress in the end decides and controls the expenditures for national defense.

The Constitution imposes on the Congress not the option but the duty "to provide and maintain a Navy" and one of the purposes of the Constitution is "to provide for the common defense." The Navy must be adequate for the purpose.

Books and articles

The following books are under revision and will be available about September 15: *Exterior Ballistics, Range and Ballistic Tables, Direct Current Laboratory Manual, Physics Manual.*

The May bulletin of the Office of Naval Intelligence lists the following current articles of professional interest:

"India's Advance towards Democracy," by Lord Lloyd. (*Fortnightly Review,* April, 1930.)

"Some Legal Consequences if Extraterritoriality Is Abolished in China," by Quincy Wright, and

"Neutrality During the European Wars of 1792-1815," by Charles S. Hyneman. (*American Journal of International Law,* April, 1930.)

"The Lines of Communication in the Dardanelles," by Lieutenant General Sir George MacMunn. (*The Army Quarterly,* April, 1930.)

"Searchlights in Air Defense," by Major J. S. Baines. (*The Army Quarterly,* April, 1930.)

Presentation

One of the most impressive ceremonies in the last "June Week" at the Naval Academy was the presentation by the Class of 1891 of the bronze replica of Tecumseh. The presentation was made by Rear Admiral Arthur L. Willard, Commandant and Superintendent, U. S. Navy Yard, Washington, D.C., and a member of the Class of 1891.

The following is quoted from the remarks of Admiral Willard on this occasion:

It is with a feeling of deep sentiment and a particular pride that I, as a member of the Class of 1891, U. S. Naval Academy, address you on this occasion when the members of that class have assembled here to give some expression of their affection for this great school which trained them for their country's service, and to present a lasting token of their reverence for and devotion to the high ideals and sacred traditions of the U. S. Naval Academy.

Tradition is one of the greatest mainsprings of human action. Traditions of families, of races, and of nations have made our present civilization. The high ideals and great deeds of our forefathers are our inspiration and govern our rules of conduct today and at the same time link us to the past. So today, our actions should be on every occasion and in every circumstance, such as to uphold those ideals of loyalty and duty, and each generation should weld and add another strong link to the lengthening chain of the traditions of the service and of our country.

It has been just thirty-nine years since the members of the Class of 1891 passed out of the portals of this Academy, ready for service in the Navy. During that time we have served through two wars and we have seen sails give way to steam and electricity, new weapons invented and used, the field of communication vastly widened, the ranges and accuracy of guns and torpedoes greatly increased, naval warfare extended from the surface of the sea to the skies above and to the depths below, and many other revolutionary changes in the composition and handling of our fleets.

During this period, the Navy's record is bright with pages of accomplishment, both in peace and in war. We of the Class of '91 are proud to have had our part in these developments and as the years of our active service draw to a close we realize more than ever that such successes and such victories as we may have won over the difficulties which lay across our individual paths, have been largely due to the training and the traditions which we received here from our Alma Mater.

It was, therefore, with a feeling of gratitude in our hearts to this great institution and those officers who guided our early footsteps here, and to all those who have maintained its high standards since the day of its establishment in 1845, that we of the Class of '91 desired to place some memorial at this Academy which would be expressive of our appreciation of the rigid training we received here during the four years when we battled for

a "two-five" in order that we might win our commissions in the Navy. We particularly desired to install a memorial which might serve as an inspiration and encouragement to those who are to come after us.

When it was learned that the most venerated object here at the Academy and the one which has most completely engaged the affections of midshipmen as the "God of two-five" and as a symbol of good luck and success for over half a century—the wooden figure of the old Indian chief which for about forty years sailed the seas as the figurehead of the U.S.S. *Delaware*—was suffering from the inroads of time and would soon crumble away and be only a memory, we turned out attentions to it.

The suggestion was made that we, the Class of '91, should reproduce the "Patron of two-five" in bronze so that he and his good influence could go on offering hope, encouragement, and inspiration to future generations of midshipmen. This idea met with instant and unanimous approval and a hearty and generous response financially from the living members of the class and the relatives of those deceased including the family of Kaga Kasu Nire of the Imperial Japanese Navy who graduated here with us, and who gave his life in the service of his country in the Russo-Japanese War.

After obtaining authority from the Navy Department we at the U. S. Naval Gun Factory undertook to cast the bronze figure and although it was no easy task, yet, thanks to our skilled artisans, the result was a complete success and we obtained a perfect replica of the wooden figure. It will interest you to know that we poured over four thousand pounds of bronze metal into the mold. This metal was obtained from ordnance materials captured in war, and therefore has an historic importance.

When the casting was completed we invited the U. S. Commission of Fine Arts to inspect it. The members of this commission—the recognized highest authority on art and architecture in America—were so impressed with the appearance of this historic figure that they said we must be careful to provide a suitable pedestal for it. At our request the commission furnished a design for this pedestal which was prepared by Mr. John W. Cross, the architect member of the commission. In keeping with this design we obtained a pedestal of green granite from the Vermont quarries. The rough block weighed fifteen tons, the second largest ever quarried there.

In order that this bronze figure may lose none of the potent power with which the midshipmen have endowed the historic wooden Indian chief, we have been careful to transfer the "wooden brains" and the "heart" of the ancient wooden Indian into this new one of bronze.

They were trepanned out of the wooden figure and together with the original arrows, tomahawk, and calumet—the pipe of peace—were placed inside the figure in a cast bronze box hermetically sealed after sterilization by heat and exhausting the air.

In order that proper records for the future may be preserved, we have placed inside this bronze box a complete list of all members of the Class of 1891 and a short résumé of their history, photographs of the wooden and bronze busts, outline of the design of the U.S.S. *Delaware,* and other documents in connection with the *history* of this venerated character and his bust.

It is well to touch upon the important points of this history.

When the U. S. ship-of-the-line *Delaware* was being built at the Norfolk Navy Yard in 1817 to 1821, Commodore John Rodgers of the Navy Commissioners, asked of Senator V. Van Dyke, one of the senators from Delaware, for suggestions for a figurehead for the ship bearing the name of that state. On January 5, 1821, a letter signed by

Senators Van Dyke and O. Horsey and Representatives Willard Hall and L. McLane of Delaware, stated that the Indian Chief Tamanend was the most distinguished chief of the Delaware Indians and his name was connected with the early history of our country, and suggested that his bust would be an appropriate figurehead for the ship-of-the-line *Delaware*.

This suggestion was duly adopted and the figurehead representing Tamanend was carved and placed on the *Delaware*. The records, so far examined, unfortunately do not disclose the name of the sculptor who carved this splendid figure. It seems probable, however, that it was the work of William Rush, a sculptor of Philadelphia and famous at that time for his carvings in wood of similar character.

This figurehead sailed the seas on and guided the destiny of the *Delaware* until April 21, 1861, when that vessel was destroyed by the Union forces when they evacuated the Norfolk Navy Yard. The figurehead was saved, however, and about 1874-76 it was brought to the Naval Academy and set up on a pedestal in the grounds where it overlooked the midshipmen as they marched to and from their recitations. The sphinx-like expression of the strong face of the old Indian made a vivid impression on the minds of the midshipmen and they conceived the idea that he possessed peculiar powers and would bestow good luck upon those who did him reverence. He was called the "God of two-five," the satisfactory or passing mark at the Naval Academy, and we all remember the days when we invoked the good will of the stern yet benevolent face of the old Indian as we passed before him.

The best records indicate that Tamanend was born about 1628 and died about 1698. His burial place is at Chalfont, Pennsylvania, about thirty miles north of Philadelphia.

He was the great friend of William Penn and welcomed the latter to America on his arrival in the Delaware country, October 2, 1682, and in 1683 he signed the "League of Friendship" under the famous Treaty Elm with Penn, in what is now Philadelphia.

History declares that Tamanend "stands foremost in the list of all great men of his nation in any age. He was a mighty warrior, an accomplished statesman, and a pure and high minded patriot. In private life he was as distinguished for his virtues as in public life he was for his talents. His countrymen could only account for the perfections they ascribed to him by supposing him to be favored with the special communications of the Great Spirit."

During the Revolutionary War the memory of the character and patriotism of Tamanend was so glorified by the Americans as well as their Indian allies that he was dubbed "Saint Tamanend" and May 1 was set upon the calendars as "Saint Tamanend's Day." It is a coincidence that May 1 is now celebrated in the Navy as Dewey Day in honor of the hero of Manila Bay.

When this figurehead was brought to the Naval Academy and set up in the grounds it did not bear any name to indicate whom it represented. As time went on the midshipmen gave it various nicknames such as "Powhatan," "Uncas," and "Tecumseh." The latter was the most popular and for the past forty years this old Indian figure, so deeply venerated by the midshipmen, has been known as "Tecumseh." Many of our admirals and captains, retired and active, remember the days when they used to salute "Tecumseh," offer the usual pennies, and invoke his blessing to the end that they might make a "two-five" on a difficult examination.

The Indian Chief "Tecumseh" of the Creek tribe was engaged for the greater part of his life in fighting Americans. His courage and military skill as well as his mercy to

his defeated enemies have won him great respect. It is a peculiar paradox, however, that we should have adopted "Tecumseh" as a nickname for Tamanend and endowed this old Indian enemy of ours with such benevolent powers for good luck.

But regardless of whether it is called "Tamanend" or "Tecumseh" this old Indian's face is so wonderfully modeled that it speaks a message all its own. We see there an expression of utmost patience, determination, courage, wisdom, and sympathy, such as should be the characteristics of a great chief as he guided and protected his tribe. It is this spirit of guidance and protection that seems to have pervaded this statue as it stood here in the Naval Academy grounds during the many years the midshipmen in their daily formations have passed under the watchful eye of their "Patron Saint" and hoped for his "blessing" and approval.

This statue in bronze resting on this solid block of Vermont granite will now defy the inroads of time. In presenting the statue of the Great Tamanend to the U. S. Naval Academy the Class of 1891 looks backward as well as forward. Backward, to the days when in the freedom of youth we enjoyed the good fellowship of our classmates and comrades, many of whom have passed from our midst but whose characters and deeds are still bright in our memory. Forward, to all the years of the future when generations of young men of America will pass through this Academy, the great "melting pot" of the Navy, where minds are trained and characters are formed, for the service of our country.

Midshipmen of the present and the future, we ask you to bind to your hearts the traditions of the service and to emulate the courage and fortitude and patience of this great Indian Chief Tamanend, of the Delawares, whose admirable traits of character are so well defined in the face of this statue.

Admiral Robison, officers, and midshipmen of the Naval Academy, we now place this symbol of our service traditions into your hands, with every confidence that the standards of this institution will, in the future as in the past, be maintained in accordance with the best "traditions of the Navy."

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Prepared under the direction of Lieutenant Commander F. P. Thomas, U. S. Navy. This book presents aircraft in its general features together with elements requisite to a fundamental understanding of the subject. 1929. 232 pages. $3.00.

Naval Aviation. Revised edition. New illustrations. 1929. 140 pages. $1.75 postpaid.

Airplanes, Airships, and Aircraft Engines.

By Lieut. Albert Tucker (CC), U. S. Navy. 1921. 436 pages. $3.50 postpaid.

ENGINEERING

Naval Auxiliary Machinery.

Compiled by officers of the Department of Engineering and Aeronautics at the Naval Academy, this book covers auxiliaries used in the naval service, which were previously treated in several textbooks. 1929. 152 pages; 11 folders; many illustrations. $3.50 postpaid.

Principals of the Basic Mechanisms.

Prepared for use of midshipmen by Lieut. Comdr. R. N. S. Baker (CC), U. S. Navy, and Associate Professor W. E. Farrell, U.S.N.A. 1926. 135 pages. $3.75 postpaid.

Engineering Materials and Processes.

Prepared as a textbook for midshipmen. Is the successor of Danforth's *Mechanical Processes.* By Lieut. Comdrs. G. B. Ashe and J. I. Hale (CC), U. S. Navy. Reprinted 1930 with slight changes and corrections. 267 pages. $2.50 postpaid.

Internal Combustion Engines.

By the Department of Engineering and Aeronautics, Naval Academy. Third revised edition. 1929. 326 pages. $3.40 postpaid.

Naval Reciprocating Engines.

Compiled by Lieut. Comdr. L. P. Bischoff, U. S. Navy. Some material has been taken from *Naval Reciprocating Engines and Auxiliary Machinery,* by Barton and Stickney, and new material added. 1929. 208 pages; many illustrations. $2.50 postpaid.

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Naval Turbines.

By Commanders O. L. Cox and M. A. Libbey, U. S. Navy. Prepared primarily for use in the instruction of midshipmen. 1924. 241 pages with many illustrations and drawings. $5.00 postpaid.

LANGUAGES

French Nautical Phrase Book and Reader.

By Professor P. J. des Garennes, U.S.N.A. 1921. 181 pages. $1.50 postpaid.

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By Professor Arturo Fernandez, U.S.N.A. 1925. 175 pages. $2.00 postpaid.

Writing and Speaking: a Handbook for Naval Officers.

By Professor Carroll S. Alden, U.S.N.A. (This book replaces *Composition for Naval Officers.*) 1927. 359 pages. $2.50 postpaid.

LAW

International Law for Naval Officers.

By Comdr. C. C. Soule, U. S. Navy, and Lieut. Comdr. C. McCauley, U. S. Navy, 245 pages. Revised 1928 by Lieut. Comdr. C. J. Bright, U. S. Navy. $2.00 postpaid.

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Reprinted 1924 with slight additions. By H. J. Fenton, M.A., LL.D. 351 pages. $2.25 postpaid.